Vol. XXIV MAY-JUNE No. 3

# NATURAL HISTORY

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

## AFRICA

MARTIN JOHNSON AND HIS EXPEDITION TO LAKE PARADISE BY CARL E. AKELEY—SCENES OF AFRICAN WILD LIFE THAT EXEMPLIFY THE PHOTOGRAPHIC ART OF MARTIN JOHNSON—THE HIGHLANDS OF THE GREAT CRATERS BY JAMES L. CLARK—THE VANISHING WILD LIFE OF AFRICA BY HERBERT LANG—AN AFRICAN BIRD THAT GUIDES MEN TO HONEY BY JAMES P. CHAPIN

AMATEUR ENTOMOLOGISTS AND THE AMERICAN MUSEUM—A BEAVER COLONY OF YELLOWSTONE PARK—THE AMERICAN MEN OF THE DRAGON BONES—WINTERING OVER A FIRE BASKET IN SZECHUAN—NATURE PHOTOGRAPHY IN THE MOUNTAINS OF WASHINGTON—DINOSAUR TRACKS IN THE ROOFS OF COAL MINES—DEAN'S "BIBLIOGRAPHY OF FISHES"

The American Museum takes this opportunity of expressing its hearty appreciation for the friendly assistance accorded its expeditions over a period of many years by government officials and others in the several sections of Africa, and for the collections from that continent which have been presented to it by interested individuals.

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY
EXPLORATION·RESEARCH·EDUCATION

ANNUAL SUBSCRIPTION $3.00 SINGLE COPIES 50 CENTS
FREE TO MEMBERS AND ASSOCIATE MEMBERS OF THE MUSEUM

# THE AMERICAN MUSEUM OF NATURAL HISTORY

## Scientific Staff for 1924

HENRY FAIRFIELD OSBORN, LL.D., President
FREDERIC A. LUCAS, Sc.D., Honorary Director
GEORGE H. SHERWOOD, A.M., Acting Director and Executive Secretary
ROBERT C. MURPHY, D.Sc., Assistant Director (Scientific Section)
JAMES L. CLARK, Assistant Director (Preparation Section)

### I. DIVISION OF MINERALOGY, GEOLOGY, AND GEOGRAPHY

#### *History of the Earth*

EDMUND OTIS HOVEY, PH.D., Curator
CHESTER A. REEDS, PH.D., Associate Curator of Invertebrate Palæontology

#### *Minerals and Gems*

HERBERT P. WHITLOCK, C. E., Curator
GEORGE F. KUNZ, PH.D., Research Associate in Gems

#### *Extinct Animals*

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Honorary Curator
W. D. MATTHEW, PH.D. Curator-in-Chief
WALTER GRANGER, Associate Curator of Fossil Mammals
BARNUM BROWN, A.B., Associate Curator of Fossil Reptiles
CHARLES C. MOOK, PH.D., Associate Curator
CHILDS FRICK, Research Associate in Palæontology

### II. DIVISION OF ZOÖLOGY AND ZOÖGEOGRAPHY

#### *Marine Life*

ROY W. MINER, PH.D., Curator
WILLARD G. VAN NAME, PH.D., Assistant Curator
FRANK J. MYERS, Research Associate in Rotifera
HORACE W. STUNKARD, PH.D., Research Associate in Parasitology
A. L. TREADWELL, PH.D., Research Associate in Annulata

#### *Insect Life*

FRANK E. LUTZ, PH.D., Curator
A. J. MUTCHLER, Assistant Curator of Coleoptera
FRANK E. WATSON, B.S., Assistant in Lepidoptera
WILLIAM M. WHEELER, PH.D., Research Associate in Social Insects
CHARLES W. LENG, B.S., Research Associate in Coleoptera
HERBERT F. SCHWARZ, A.M., Research Associate in Hymenoptera

#### *Fishes*

BASHFORD DEAN, PH.D., Honorary Curator
JOHN T. NICHOLS, A.B., Associate Curator of Recent Fishes
E. W. GUDGER, PH.D., Associate in Ichthyology
CHARLES H. TOWNSEND, Sc.D., Research Associate

#### *Amphibians and Reptiles*

G. KINGSLEY NOBLE, PH.D., Curator

#### *Birds*

FRANK M. CHAPMAN, Sc.D., Curator-in-Chief
W. DEW. MILLER, Associate Curator
ROBERT CUSHMAN MURPHY, D.Sc., Associate Curator of Marine Birds
JAMES P. CHAPIN, PH.D., Associate Curator of Birds of the Eastern Hemisphere
LUDLOW GRISCOM, M.A., Assistant Curator
JONATHAN DWIGHT, M.D., Research Associate in North American Ornithology
ELSIE M. B. NAUMBURG, Research Associate

#### *Mammals of the World*

H. E. ANTHONY, A.M., Associate Curator of Mammals of the Western Hemisphere (In Charge)
HERBERT LANG, Associate Curator of African Mammals
CARL E. AKELEY, Associate in Mammalogy

#### *Comparative and Human Anatomy*

WILLIAM K. GREGORY, PH.D., Curator
S. H. CHUBB, Associate Curator
H. C. RAVEN, Assistant Curator
J. HOWARD MCGREGOR, PH.D., Research Associate in Human Anatomy

### III. DIVISION OF ANTHROPOLOGY

#### *Science of Man*

CLARK WISSLER, PH.D., Curator-in-Chief
PLINY E. GODDARD, PH.D., Curator of Ethnology
N. C. NELSON, M.L., Associate Curator of Archæology
CHARLES W. MEAD, Assistant Curator of Peruvian Archæology
LOUIS R. SULLIVAN, PH.D., Associate Curator of Physical Anthropology
J. ALDEN MASON, PH.D., Assistant Curator of Mexican Archæology
CLARENCE L. HAY, A.M., Research Associate in Mexican and Central American Archæology
MILO HELLMAN, D.D.S., Research Associate in Physical Anthropology

#### *Animal Functions*

RALPH W. TOWER, PH.D., Curator

### IV. DIVISION OF ASIATIC EXPLORATION AND RESEARCH

#### *Third Asiatic Expedition*

ROY CHAPMAN ANDREWS, A.M., Curator-in-Chief
WALTER GRANGER, Associate Curator in Palæontology
FREDERICK K. MORRIS, A.M., Associate Curator in Geology and Geography
CHARLES P. BERKEY, PH.D., [Columbia University], Research Associate in Geology
AMADEUS W. GRABAU, S.D. [Geological Survey of China], Research Associate
CLIFFORD H. POPE, Assistant in Zoölogy

### V. DIVISION OF EDUCATION AND PUBLICATION

#### *Library and Publications*

RALPH W. TOWER, PH.D., Curator-in-Chief
IDA RICHARDSON HOOD, A.B., Assistant Librarian

#### *Public Education*

GEORGE H. SHERWOOD, A.M., Curator-in-Chief
G. CLYDE FISHER, PH.D., Curator of Visual Instruction
GRACE FISHER RAMSEY, Assistant Curator

#### *Public Health*

CHARLES-EDWARD AMORY WINSLOW, D.P.H., Honorary Curator
MARY GREIG, Assistant Curator

#### *Astronomy*

G. CLYDE FISHER, PH.D. (In Charge)

#### *Public Information Committee*

GEORGE N. PINDAR, Chairman
GEORGE H. SHERWOOD, A.M.
ROBERT C. MURPHY, D.Sc.

## Natural History Magazine

HERBERT F. SCHWARZ, A.M., Editor and Chairman
A. KATHERINE BERGER, Assistant Editor

#### *Advisory Committee*

H. E. ANTHONY, A.M.
JAMES P. CHAPIN, PH.D.
E. W. GUDGER, PH.D.
FREDERICK K. MORRIS, A.M.
G. KINGSLEY NOBLE, PH.D.
GEORGE N. PINDAR

# South America

**South America,** the continent to which the July-August issue of NATURAL HISTORY is to be devoted, has long been a favorite field of zoölogical exploration, thanks to the diversity of animal life that such contrasted environments as tropical jungle, Andean height, and desert coast afford. Dr. Frank M. Chapman, who has but recently returned from the tip end of the continent, where he has been pursuing his study of the South American birds, will contribute an entertaining description of some of his experiences in that part of the world. The heart of the Andes of Ecuador has been explored by Mr. H. E. Anthony, in charge of the department of mammals, American Museum, who will tell through his beautiful pictures and his no less vivid text some of the attractions of the region. A feature of interest will be reproductions of several of the inspiring landscapes of Frederic E. Church, painter of the high Andes, and excerpts from the journal of his travels. From the snow line the next contributor, Mr. Herbert Lang, associate curator in the department of mammals, invites the reader to descend to the tropics and journey with him along the forest-flanked Mazaruni River into the heart of British Guiana, the interest of which he reveals in a well-illustrated article. Articles by contributors connected with institutions other than the American Museum are promised, and the magazine is glad to have the opportunity of giving recognition to the important work they are doing. Mr. Wilson Popenoe, of the United States Department of Agriculture, will describe some of the fruits that he has studied in Ecuador with a view to their introduction and cultivation in the United States, and Mrs. Edmund Heller will give an account, full of sprightly incidents, regarding some of the wild animals which became important members of the expedition that Mr. Heller and she made through Peru on behalf of the Field Museum.

**Panama** is a region that has affiliations with South as well as North America notwithstanding the fact that a masterpiece of engineering has consigned it to the latter. To Panama the American Museum has sent several expeditions. Dr. Frank E. Lutz, recently returned from the region, will tell, with delightful touches of humor, about his field studies of the stingless bees,—studies which have contributed to the knowledge of these interesting insects. Mr. Ludlow Griscom, who ventured into a portion of Panama that is forbidden territory to the white man, will contribute an account of his adventures and observations.

**MARTIN JOHNSON GETTING READY FOR ACTION**

With an equipment such as no photographic expert has previously carried into Africa, Martin Johnson should bring back from his

# NATURAL HISTORY

VOLUME XXIV MAY-JUNE NUMBER 4

## Martin Johnson and His Expedition to Lake Paradise

A CULMINATING CHAPTER IN THE HISTORY OF WILD-LIFE PHOTOGRAPHY, WITH A SURVEY OF SOME OF THE EARLIER STAGES IN THE DEVELOPMENT OF ITS TECHNIQUE

BY CARL E. AKELEY

MARTIN JOHNSON GETTING READY FOR ACTION

With an equipment such as no photographic expert has previously carried into Africa, Martin Johnson should bring back from his [illegible]

WE of today have but a faint conception of the Africa of fifty years ago. South Africa was then known to the world as a land teeming with game. On the veldt occupied by the Boers the game was being used for food and clothing. The "hinterland" was untouched except by missionaries, ivory hunters, and traders. Equatorial Africa was almost unknown. Only in recent years when the game of the south had been killed off and driven back and some of the species had been exterminated, were the game fields of the equatorial region explored —and exploited. And now the great game fields of the past are but a memory. Here and there are "game pockets" where, in a congested area, may be seen what appears to be an inexhaustible number of animals, but once one of these pockets is "discovered" and made known to the world, the slaughter begins, the pocket is emptied. Such a pocket was Stewart Edward White's "Undiscovered Territory;" Ngorongoro, the great crater of Tanganyika Territory, and Lake Paradise, referred to later in this article, are similar teeming centers of game. Others will be located, each one doomed in its turn, unless Herculean efforts be made to arrest the progress of destruction. Where there is one individual eager to conserve, there are a dozen bent on slaughter—for gain, "sport," or some one of many pretexts. Hardest of all to combat is the claim that the game animals carry and spread the diseases of domestic stock. The perennial cry, "The game must go; this is no longer the world's zoo but an agricultural country," is heard throughout Africa. There is just one relieving circumstance in this doleful prospect: what man seems bent upon destroying with his gun can at least be rescued from complete oblivion and given the illusion of reality through the camera operated by the right kind of individual.

Forty years ago, shortly after George Eastman had put the first dry plates on the market, no one, perhaps, dreamed of the possibility of making a photograph of a live wild animal. Even twenty-seven years ago, when I started on my first African journey, there was much discussion as to the advisability of encumbering the expedition with a camera, fortunately decided in favor of the camera. Compared with those used at the present time, photographic lenses were slow, and plates and films likewise. Telephoto lenses were in their infancy. We made practically no attempt to photograph live animals.

But few pictures of wild game had come out of Africa at the close of the nineteenth century, and most of these were of dead or wounded animals that

could not escape the camera man. A few photographs of free live animals had been made by Lord Delamere, Mr. E. N. Buxton, and others, that were interesting in their suggestion of further possibilities.

Toward the close of the nineteenth century C. G. Schillings began the work in German East Africa which, after about seven years of arduous effort, resulted in his book, *Flashlights in the Jungle*. This was the greatest contribution of wild-life photographs that until then had been made by any one man. Before that, wild life was recorded for the most part with pen and pencil—too often combined with hearsay and imagination. In *A Breath from the Veldt* by J. G. Millais, published in 1895, we have the finest example of pen and pencil records of African wild life. Few indeed have combined the keen powers of observation and pictorial skill of Millais. *A Breath from the Veldt* is a work of enduring value and charm. The serial sketches, such as "Springbuck Crossing a Road," "Evening Play of the Bush Khoorhan," are real "motion pictures," convincing and pleasing. Dugmore gave us a wonderful record of several months of strenuous work with flashlight and camera in British East Africa. In 1908, with James L. Clark as a bodyguard, he secured material for a book replete with remarkable photographs.

The first of the noteworthy motion pictures of African game to come to this country were those brought by Paul Rainey. The waterhole pictures were a revelation, although technically they were far from good. They were made by Mr. Lydford of Nairobi, who had not previously taken motion pictures and whose photographic equipment was inferior. The waterholes have been photographed frequently and with better results since, and last and best by Martin Johnson. In the interval between Rainey and Johnson, James Barnes with Cherry Kearton gave us a good impression of the waterholes in their photographic journey across Africa from the east coast to the mouth of the Congo. Bengt Berg made a beautiful series of pictures of the birds of the Nile. Dugmore and Harris came back a year ago with a good film of East African game. There are many fine bits of film scattered about in the collections of a score or more of others who, as sportsmen or travelers, have made conventional trips to Africa in recent years.

In the forty or more years that have elapsed since the achievement of Eastman above alluded to, photographic equipment has been devised that, placed in the right hands, assures results formerly unattainable. With the roll film and the kodak amateur photography was launched. Development of the flashlight photograph, made possible by the magnesium flash powder, fast lenses, and highly sensitive film, stimulated interest still more. In 1892, after several years of experimenting, George Shiras 3d, a pioneer in wild-life flashlight photography, advanced its technique to a degree of efficiency that resulted not only in the beautiful examples that he produced, but also in a great popularization of that form of photography. Today, as a result of the development of the celluloid gelatin film of high sensitiveness, fast lenses, telephoto lenses, and motion picture, it is possible to make records of wild life that are of infinite scientific value and popular interest. I say possible. At the present time all the necessary tools are available, but a complete outfit of cameras, lenses, and necessary equipment for making

general wild-life studies costs many thousands of dollars, and when such an equipment has been assembled, it is not of much use except in the hands of a man of vast experience, gained of necessity through years of hard work prompted by an unquenchable desire to carry on. The rare elements of this combination required to secure the priceless records of a fast-vanishing wild life are an "A" man to do the work and a man, or men, with vision and idealism to see that he is backed financially.

To make a life-history picture of an animal such as the elephant, for instance, is a tremendous undertaking. It involves photographing the animal in its various moods and under conditions that are as varied as the types of country it inhabits, from the low-lying coast lands to the snow fields of the equatorial mountains; pursuing the animal as it travels over thirst lands where at times for water it is dependent on the moisture contained in aloes or other plants of the arid regions, or the seepage that results when the powerful beast digs holes in the sand of the dry stream beds. At other times the photographer may be half-submerged in swamps and marshes, or trekking the grass lands of the high plateaus or the bush veldt, or lost in the somber shadows of the great forests, or clambering up steep cliffs, or "tobogganing" down a greasy slope. He will have to seek out the mother elephant with her new-born babe in her retreat away from the trails of her kind, where she remains until the youngster is strong enough to join in the treks of its elders. To make such a life-history picture requires a great deal of time, infinite patience and enthusiasm, and a willingness to dice with death; and the elephant is but one of hundreds of species of animals that await the man with the skill, perseverance, and backing to record their fascinating life stories for science and the world at large.

Martin Johnson, the American Museum believes, is a man who measures up to these standards. Through years of hard but joyous work "on his own" he has gained the experience and demonstrated to the world his ability to meet the most exacting requirements as the "man behind the camera." Seventeen years ago he was with Jack London, voyaging in the "Snark" through the South Seas. There he came in contact with a motion-picture camera that was in the hands of some men who were tired of their job, and took it over; ever since that time he has devoted all his energies to the production of motion-picture films. He made splendid records of primitive life in Polynesia, the New Hebrides, Borneo, and Africa. Much of this material is of inestimable value. Because of rapidly changing conditions in these lands some of it could not now be duplicated, and its preservation for all time for the benefit of the world is assured, for Johnson with characteristic generosity has turned over all his negatives, still as well as motion, to the American Museum.

A year ago Mr. and Mrs. Johnson returned from their first journey to Africa and gave to the world a photographic record of African game that was of greater interest and beauty than any that had been brought out of Africa before.

As a result of the American Museum's appreciation of the importance of Johnson's work, a group of men, headed by Mr. Daniel E. Pomeroy and including two of the Trustees of the American Museum, Mr. F. Trubee Davison and Mr. A. Perry Osborn,

undertook to send him back to Africa for a period of five years to do the things he wanted to do: to make pictorial life-history records of the people and the wild animals of the jungle, plain, and forest, unhampered by the necessity of paying tribute or of catering to purely financial interests. To Mr. Pomeroy and his associates the Museum and the public owe much, not only for making possible the work that lies ahead but for that already accomplished.

Mr. and Mrs. Johnson have reached the spot that will be the scene of their activities during the next five years. It has been named by them Lake Paradise and is a small crater lake somewhere near the northern border of Kenya Colony. To them it is a veritable paradise, for it is a region that has not been invaded by the sportsman, where animal life is abundant and unfrightened—an ideal place for Johnson's work. And what he proposes to do there cannot be better indicated than in his own words.[1]

For seventeen years I have been wandering here and there in the tropics, and for fourteen years Mrs. Johnson has been with me, photographing the strange and interesting things we have seen. But neither of us is content with thinking of the things we've seen or the pictures we've taken. What we've done is done, and while we feel that we have done something to create a better understanding of the out-of-the-way spots we have visited, we are not satisfied that we have done our best. To us what we have done seems now as if it were a course of training, and now we want to do something better, something more valuable, and more permanent. If it is not done now, it will never be done, and so it is that this expedition is being financed.

We will bring back with us a vivid portrayal of untouched Africa—a picture of the beauties of the last of the great continents to be explored—a picture of the natives and the animals as they live their lives all but untouched by civilization—unaffected by the worries of the outside world. We will get a picture that will be a record for a thousand years to come, of Africa as God made it, before the white man penetrates further into its beautiful wilds, and before the natives and the wild animals have disappeared.

Our prime purpose is to photograph Africa and the inhabitants of Africa—to photograph them as they normally exist—to photograph them in their wanderings, in their play, in their migrations and their congregations—in their natural relations to each other and to the world in which they live. Thrills in plenty we will have—and I hope we'll photograph many of them—but they are incidental to our main purpose, which is to secure a truthful, accurate, complete, and interesting picture of Africa as it is—not a picture of "The Adventures of Mr. and Mrs. Martin Johnson."

There is no question that Martin Johnson is the man to do the work that has just been outlined. The American Museum is seeing to it that he has the moral support and Mr. Pomeroy and his associates are generously supplying the financial backing to make the great undertaking possible. The negatives of the pictures, both still and motion, that the expedition secures, will become the property of the American Museum, to be held as a permanent record of African wild life, and the films before passing into the regular channels of distribution will be edited by members of the scientific staff of the Museum, with a view to making them error-proof and of as great educational value as possible. Public appreciation of what has been done already, and of the importance of the undertaking, should be such as to guarantee that the work of Johnson may go on indefinitely.

[1] The passage that follows is taken from *World's Work* for August, 1923, but the order of the paragraphs has been changed somewhat to meet the present requirements.

# Scenes from the Plains and Jungles of Africa

REPRODUCTIONS IN DUOTONE FROM PHOTOGRAPHS

By MARTIN JOHNSON
Leader of the Martin Johnson African Expedition

THE AFRICAN BUFFALO

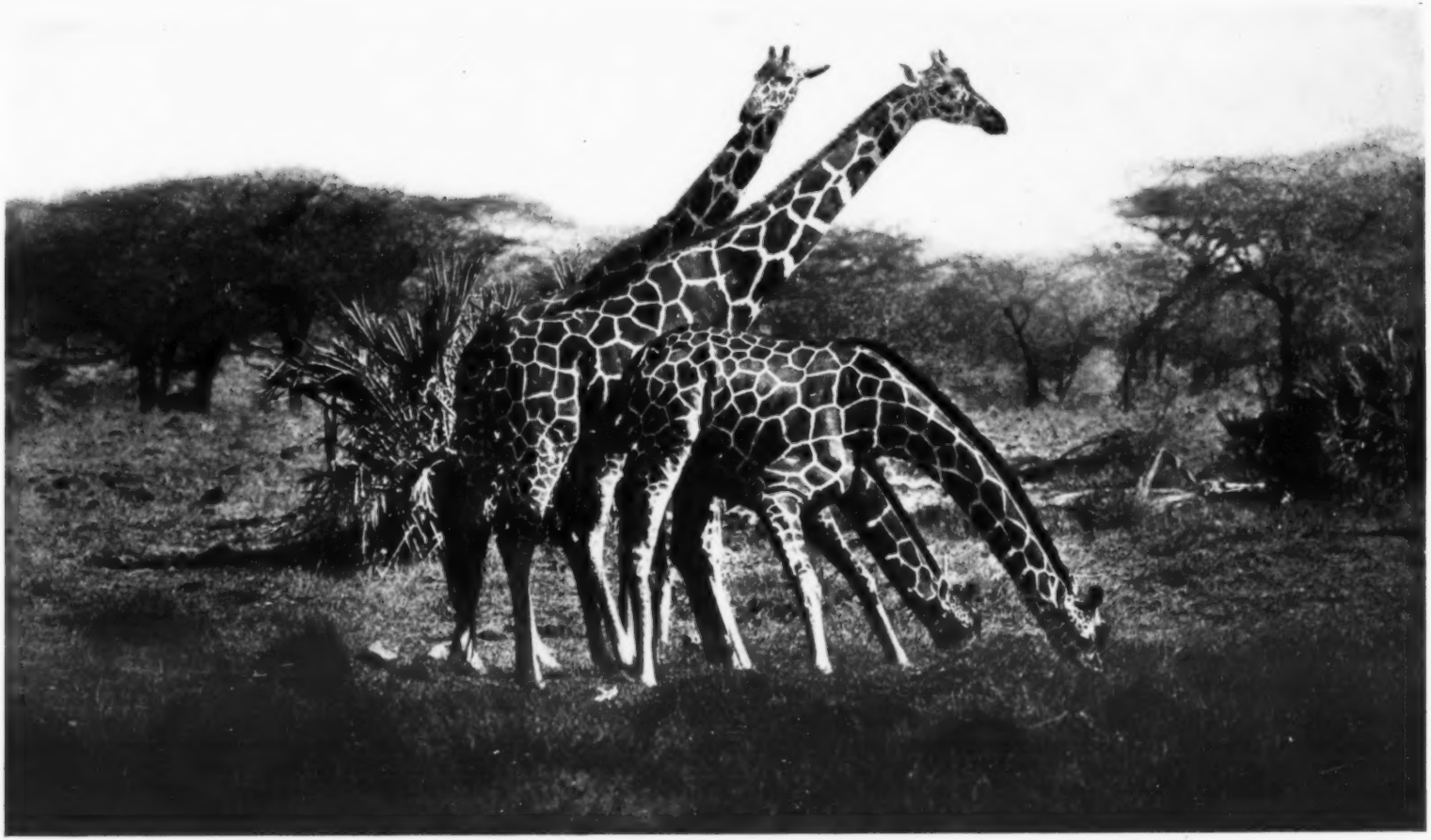
The buffalo is better equipped to take care of itself under adverse conditions than are most animals. Several decades ago the rinderpest swept off vast numbers, but the isolated small herds that escaped this scourge were apparently sufficient to restock the country.

The animal shown in the picture is probably a straggler from a herd. Lone bulls and small bands of old bulls often wander about independent of the main herds, which may consist of as many as 500 individuals. Some herds habitually live in swamps, rarely moving far afield on the hard ground; others live in bush country and go to swamps and streams only for water; and still others roam over the open plains but promptly take to the bush if hunted

ELANDS

The eland, the largest of the antelopes, is easily domesticated. Young ones will sometimes join herds of domestic cattle, being adopted by them

The eland, the largest of the antelopes, is easily domesticated. Young ones will sometimes join herds of domestic cattle, being adopted by them



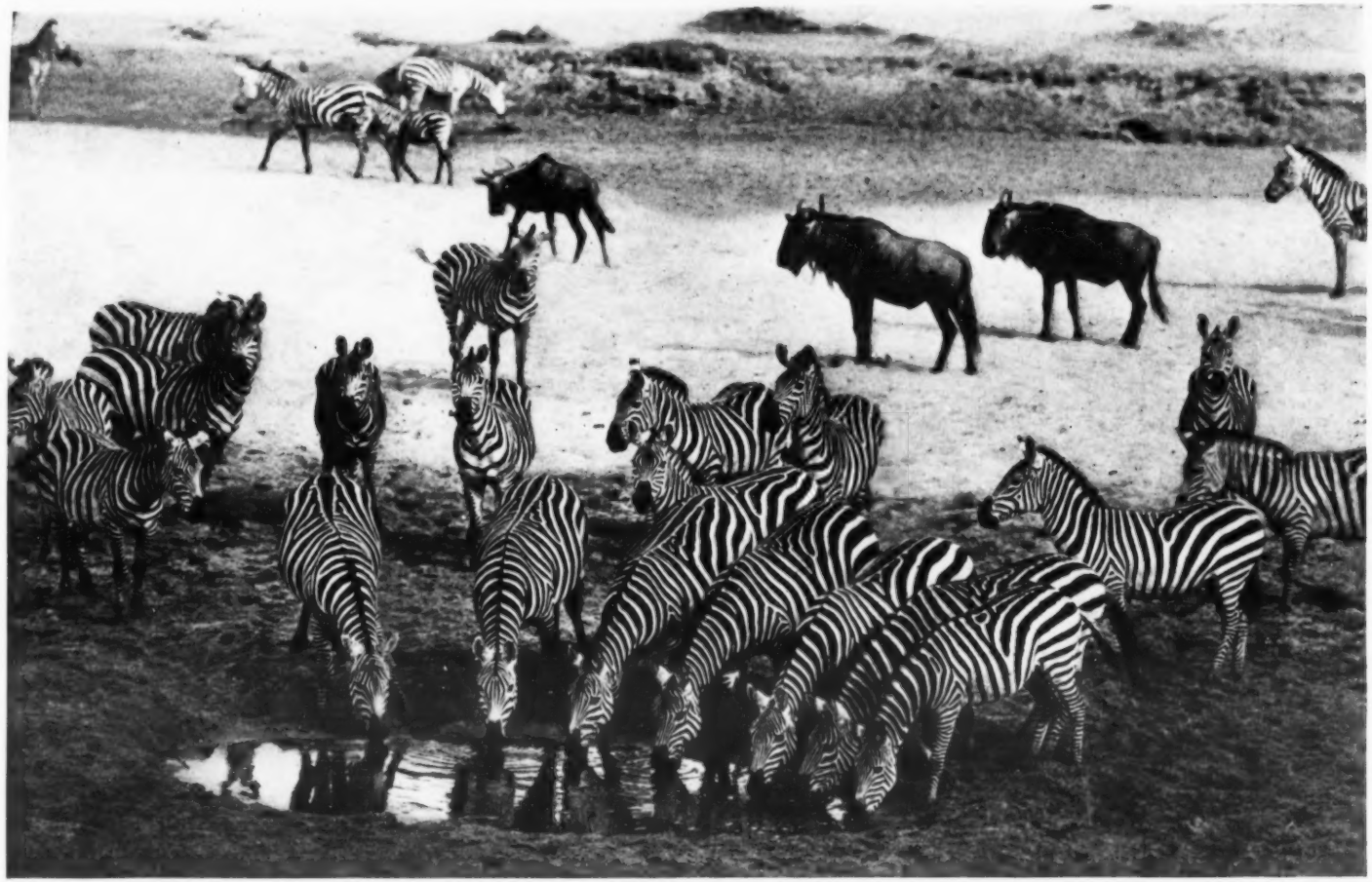
GIRAFFES AT THE EDGE OF A SWAMPY WATER HOLE

The giraffe is one of the most picturesque animals of Africa. It is inoffensive, inflicting injury neither on man nor his crops

THE ATTRACTION OF THE WATER HOLE

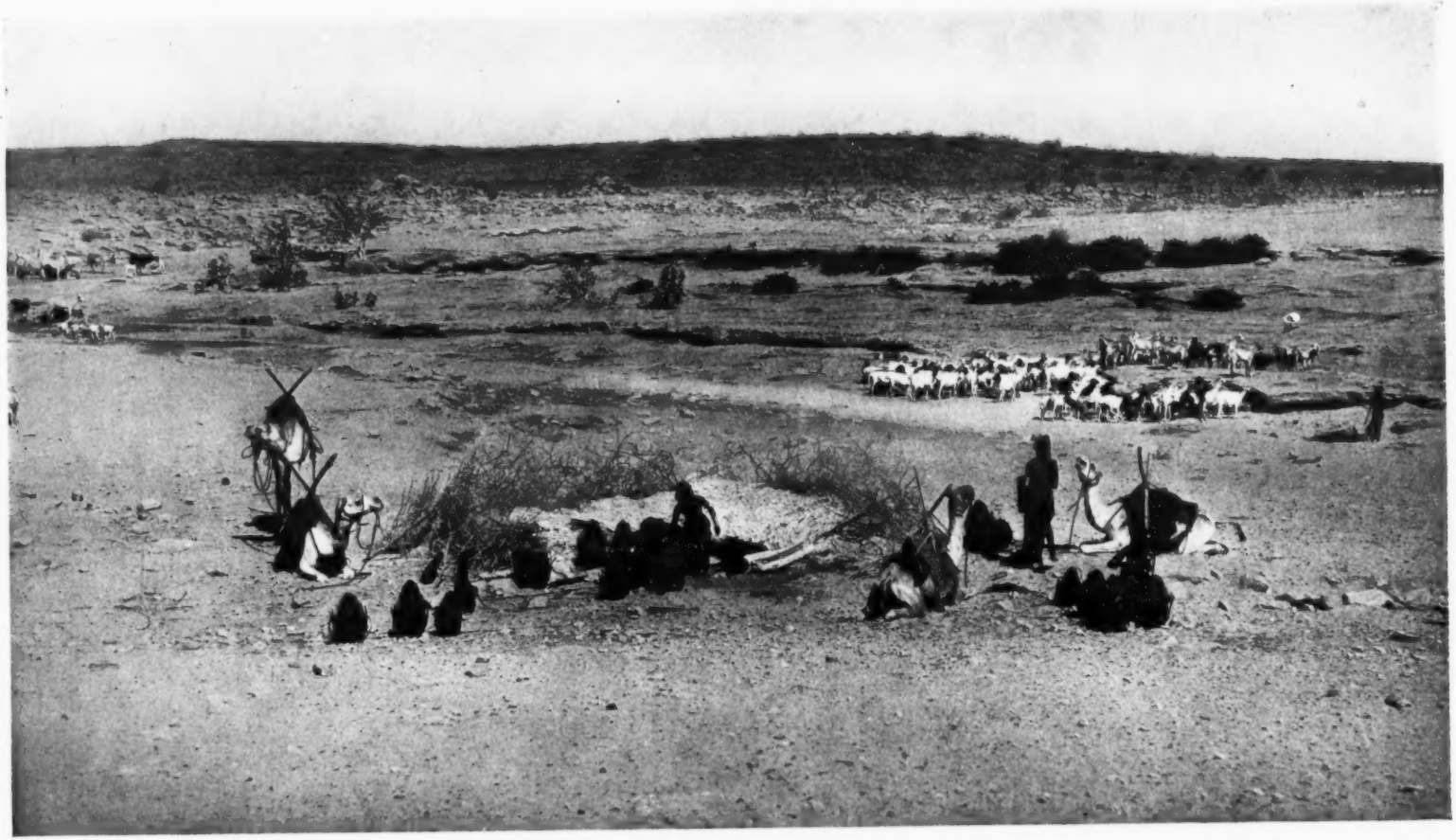
From the left a herd of impalla is making its approach; at the hole itself are several oryx, distinguished by their rapier-like horns; in the background zebra are loafing about; and in the far distance a small group of game is distinguishable

ground zebra are loafing about; and in the far distance a small group of game is distinguishable
292



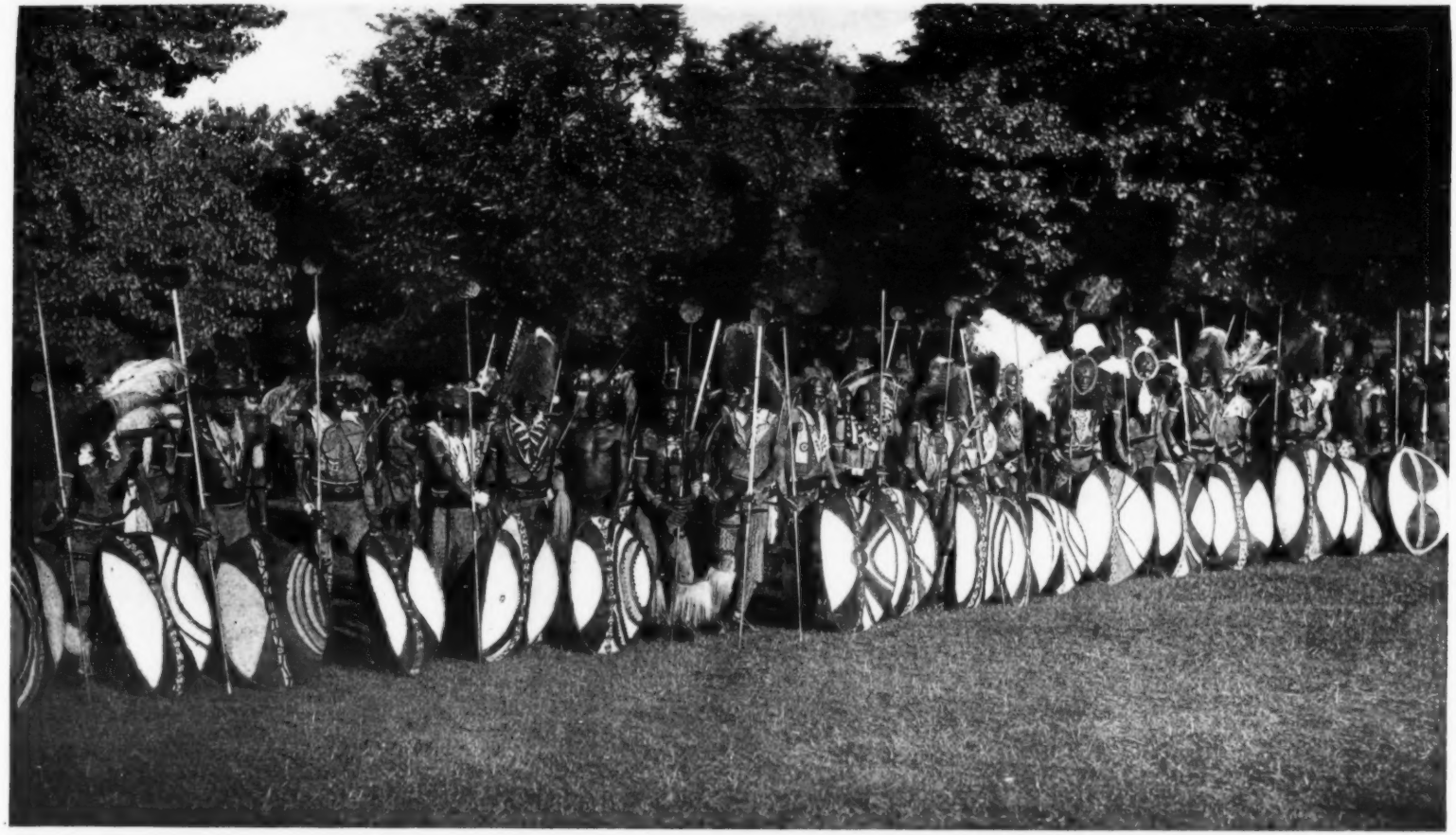
BURCHELL'S ZEBRA AND THE BRINDLED GNU

Burchell's zebra is one of the most abundant of the wild animals of equatorial Africa. It is a favorite food of the lion. Although sometimes domesticated, the zebra has not proved very useful as a beast of burden



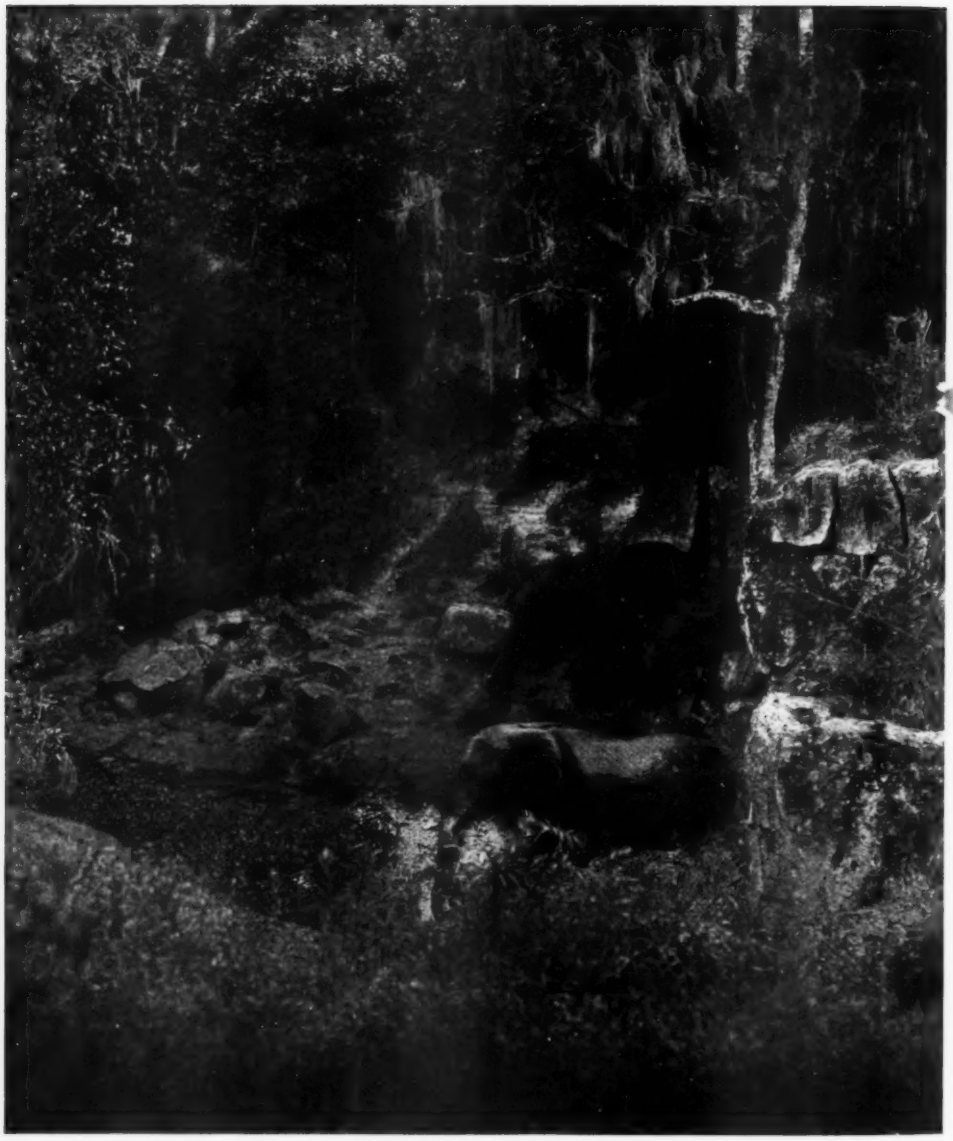
NATIVES WITH THEIR FLOCKS

In arid regions the natives frequently travel long distances to obtain their water supply, filling the fiber vessels which they bring for the purpose



IN FULL REGALIA

Although these natives bear shields and are armed with spears, their intent is pacific, indicated by the pompons of ostrich feathers carried on the spear points and known as "peace balls." Feasting and dancing are features of the tribal gatherings



ELEPHANTS IN FORESTED COUNTRY

Martin Johnson intends among other things to record in motion picture the life history of the elephant. Lake Paradise, where he is encamped, offers exceptional opportunities for the study of this animal.

One of the elephants in the picture is raising his flexible trunk to pull down a branch,—one of the many functions that this adaptable organ performs. As Mr. Akeley has pointed out, an elephant "drinks with it, feeds himself with it, smells with it, works with it, and at times fights with it"

"Lone Tree Camp," on the crater floor near the northeast wall, looking southwest across the crater, with Oldeani at the left

# The Highlands of the Great Craters[1]

## WITH SPECIAL REFERENCE TO THE VAST CRATER OF NGORONGORO

By JAMES L. CLARK

Assistant Director (In Charge of Preparation), American Museum

NEARLY due south and less than 150 miles from the well-known and active little town of Nairobi, and just within the northern border of Tanganyika Territory—formerly German East Africa—lies one of those isolated bits of interesting and beautiful country that are so characteristic of Africa. It is known as the Highlands of the Great Craters, so named on account of the many interesting craters that break its great surface into an almost continuous series of immense basins, splintered peaks, and deep ravines. Resting like a crown on the peak of this wonderful stretch of mountainous highland country, that rises green as an oasis in the center of a great expanse of arid African plains, are the perfect remains of the largest crater in the world—Ngorongoro or, as the natives call it, Ngoro.

In 1909 I spent months hunting along the border that separates the Highlands of the Great Craters from British East Africa, yet I heard nothing that even indicated the existence of this place, and to my many queries, addressed to men who should have known, as to what lay beyond, I received only one answer: "A God-forsaken, low, hot country, where there is nothing except bush and fever."

For the past fifteen years big safaris have been radiating from Nairobi all through this East African section in all

[1] The photographs accompanying this article were taken by the author with the one exception noted.

*Phot graph by Captain Hurst*

Oldonyo Lengai, "The Mountain of God" in the language of the Masai.—This peak in the group of the great craters lies about fifty miles north of Ngoro. It erupted twice during the late war, the last time being in 1917, and still lies barren for the most part in its cloak of colored muds. Only here and there a bit of vegetation is doing its best to get a start

directions, shooting and reshooting over the same ground and trekking far north for possible new and less-disturbed fields, yet this beautiful spot with its unmolested herds of game lay untouched—safe, for a time at least, from the onslaughts of the sportsman.

During my sojourn at this time, I was perhaps less than a hundred miles from this locality, being then in the the great southern preserve of British East Africa, which on account of its great abundance of game was set aside as a source of replenishment for all outlying districts. The general ignorance of this wonderland's existence seems somewhat surprising when account is taken of the fact that in 1894 there had appeared a publication in German by a Dr. Oscar Baumann, in which reference is made to it. It had also been explored by Dr. Fritz Jaeger in 1906–07, who conferred upon it the name of the Highlands of the Great Craters (Das Hochland der Reisen-krater) in the monograph that he issued in 1913.

Geographically there is no barrier to the region: the great Athi Plains roll south through the southern game preserve, over the border, and far beyond. Way to the east stands the great mountain of Kilimanjaro and its smaller but more rugged companion, Mt. Meru. This section was fairly well known, as the fertile slopes, fed by the melting snows that flow from these peaks, drew adventurers and settlers to this land of promise. But to the west and between was still a blank so far as the English-speaking world was aware.

After the War a few scattered reports began to be circulated of a wonderful country that lay in the center of this supposedly barren area. The first English-speaking party to enter the Highlands of the Great Craters was that of Sir Charles Ross, who in the winter of 1921–22, accompanied by Mr. T. Alexander Barnes, made the

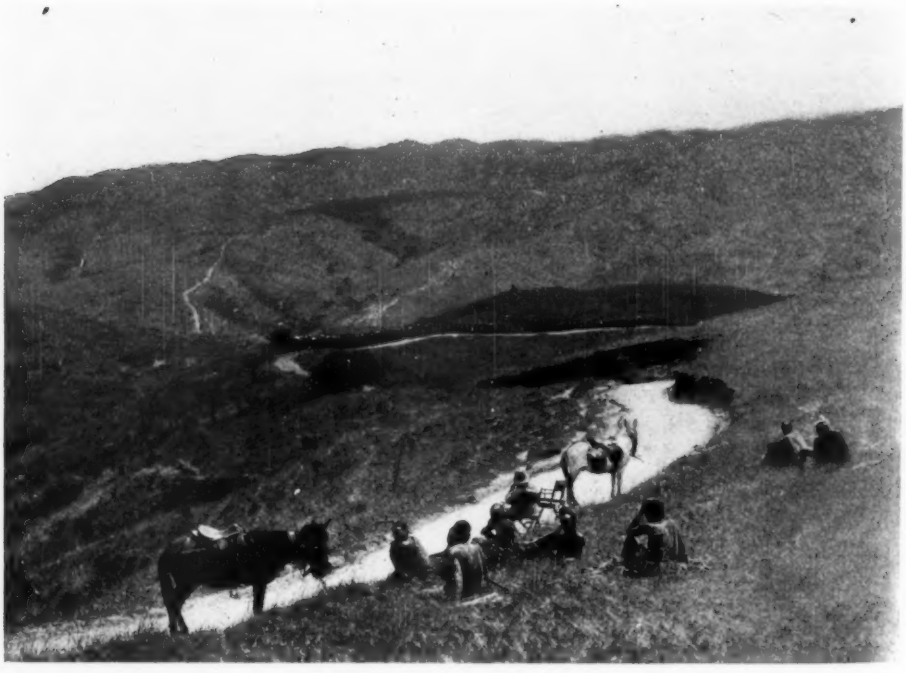
Kilimanjaro photographed with a seventeen-inch telephoto lens from Moshi, about fifteen miles distant. An extinct volcano, 19,456 feet high and 3° 40′ south of the equator, it is the highest of all the mountains of Africa and with Mt. Kenia (17,040 feet) and Elgon (14,140 feet) forms one of the three great landmarks of the East African section. Its blanket of snow, estimated to be 200 feet thick on the top, extends down its slopes for 6000 feet

trip and brought out information regarding their marvels. That fall, equipped with the maps and information Sir Charles had given me, I made the same trip, being a member of what, I believe, is the first American party that has visited the region. The fact that it is located as it is, away from the beaten routes of the trading and hunting safaris, and with the uninviting, arid plains about it, explains perhaps why it has enjoyed its years of secluded peace.

Our route started from railhead at the little town of Moshi, that nestles on the southeast slope of Kilimanjaro, at about 2800 feet, and proceeded thence to the delightful little post of Arusha on the slopes of Mt. Meru, where the climate bids one linger as long as his time will permit.

From Kilimanjaro west the country rolls along in rather hot arid plains, only occasionally relieved by small broken hills, which are the eroded remains of small volcanoes, until it reaches its lowest level in a hot flat bush country, about a hundred miles from the mountain. Confronting us at this point an escarpment 2000 feet in height rises sheer; it is the western wall of the great Rift Valley, which runs north and south, more or less distinctly traceable for a thousand miles, and is the result of a great slump that took place in some prehistoric time. At the base of this lies Lake Manyara, which today has shrunk to a fraction of its former size, and in its retreat has left a floor as flat as a table and miles in extent. Around the shores of this lake extends a great tsetse fly belt, which for safety's sake is traversed at night, and as there is no camping ground until the top is reached, the precipitous wall is climbed in darkness by following a native trail. In the morning one looks down on a great relief map, over which he has been trekking for days. The climate has changed, and the traveler finds himself in a rich green rolling country—the

Looking northwest from the floor of the Rift, the old bed of the receded Lake Manyara to the left with the shore line showing distinctly on the right.—The clean-cut western escarpment of the Rift is clearly seen running north and south. Ngoro is the great bulk in the background that rises from the escarpment into the clouds that obscure it. The distance from the point where the picture was taken to the crater is about thirty miles. The three elevations are well defined: floor of the Rift, 3000 feet; escarpment, 5000 feet; crater edge of Ngoro, 8000 feet



After leaving Mbulu the safari trekked northward over the rolling upland shelf

Looking north from "World's View."—The great sweep downward between "World's View" and Ngoro mountain is indicated in this picture

land of the Wabulu (the People of the Mist),—which supports fine, well-fed herds of cattle, sheep, and goats, is well supplied with water, and is covered with great patches of forest.

Emergence into such a delightful environment after the trek over the heated plains below, has an invigorating effect, and at this elevation of about 5000 feet, one gets a more refreshing sleep in the cool of the night air.

Turning northward and traveling through these rolling highlands for three or four days, one nears the Great Crater. A height of land is reached on the third day, and after the ascent to its great ridge, we stand on what is justly named "World's View." Looking back over the green upland shelf just traversed, the traveler sees far below and beyond the expanse of yellow plains, obscured in the haze of heat.

To the north the country makes a great sweep downward, retaining its olive green tinge except in the lowest valleys, where it becomes a bit parched, and terminates in the great mountain of Ngorongoro. One sees the crater's southern edge, rising to 8000 feet elevation, extending far to the east and west. It appears like an unbroken mountain ridge stretched between two higher volcanic mountains (Ololmoti and Oldeani), the crater edges of which show sharp against the sky, but these are indeed merely blowholes on its sides. These peaks rise to 10,000 feet each, and although great mountains in themselves, they are dwarfed into insignificance when viewed later as protuberances upon the crater ridge.

To the east the descending slopes make their way unbroken until they terminate abruptly at the edge of the great rift; then there is a sheer drop

Oldeani as it appears to one approaching from the southeast.—The ridge to the right is the start of the crater edge of Ngoro, which continues unbroken to the east. Viewed from this point of observation, the crater seems to extend for a distance about four times that of the width of Oldeani mountain. To the west the slope is gradual. In the foreground is the great sweep of rolling country between "World's View" and the crater. From the point of observation to the crater the ground rises steadily until it approaches that formation, when it makes a rather steep grade to form the outer wall. One does not enter dense forest until this outer wall is reached

into the plains far below that lets one's vision range on and on over the rolling country that ripples off to the horizon.

To the west the slopes descend gradually to arid plains of scattered bush lost in the distance. So it is that one stands almost in the center of this immense oasis and views the great dry plains that have been the barrier to its penetration.

We descend and trek toward the Great Crater, to make camp at the edge of the forest that enshrouds its rim. As we make our way down and are shut in by the rolling hills, we lose its form, and ahead there seems nothing but hilly country. We camp for the night and obtain a good rest, for the morrow means a stiff climb up the steep grade of the outer slopes, through the winding trails of a jungle forest.

Our guns are always ready: we may encounter a rhino or a buffalo, or even an elephant moving about on the morning feeding grounds. The vegetation is so dense that man and beast may meet unexpectedly at close quarters.

The whole morning is consumed in this uphill jungle trek, with frequent rests for our safari, for the altitude of about 8000 feet is beginning to make itself felt. The top is reached by noon. There the open glades become larger and more frequent. Finally we discover a level spot, and halt for a noonday rest. There is an opening in the trees beyond; going to this and making our way forward through some bushes, we find ourselves on the brink of the crater, and gaze over.

A feeling of awe grips one upon looking for the first time into this great basin. Can it be possible? Was

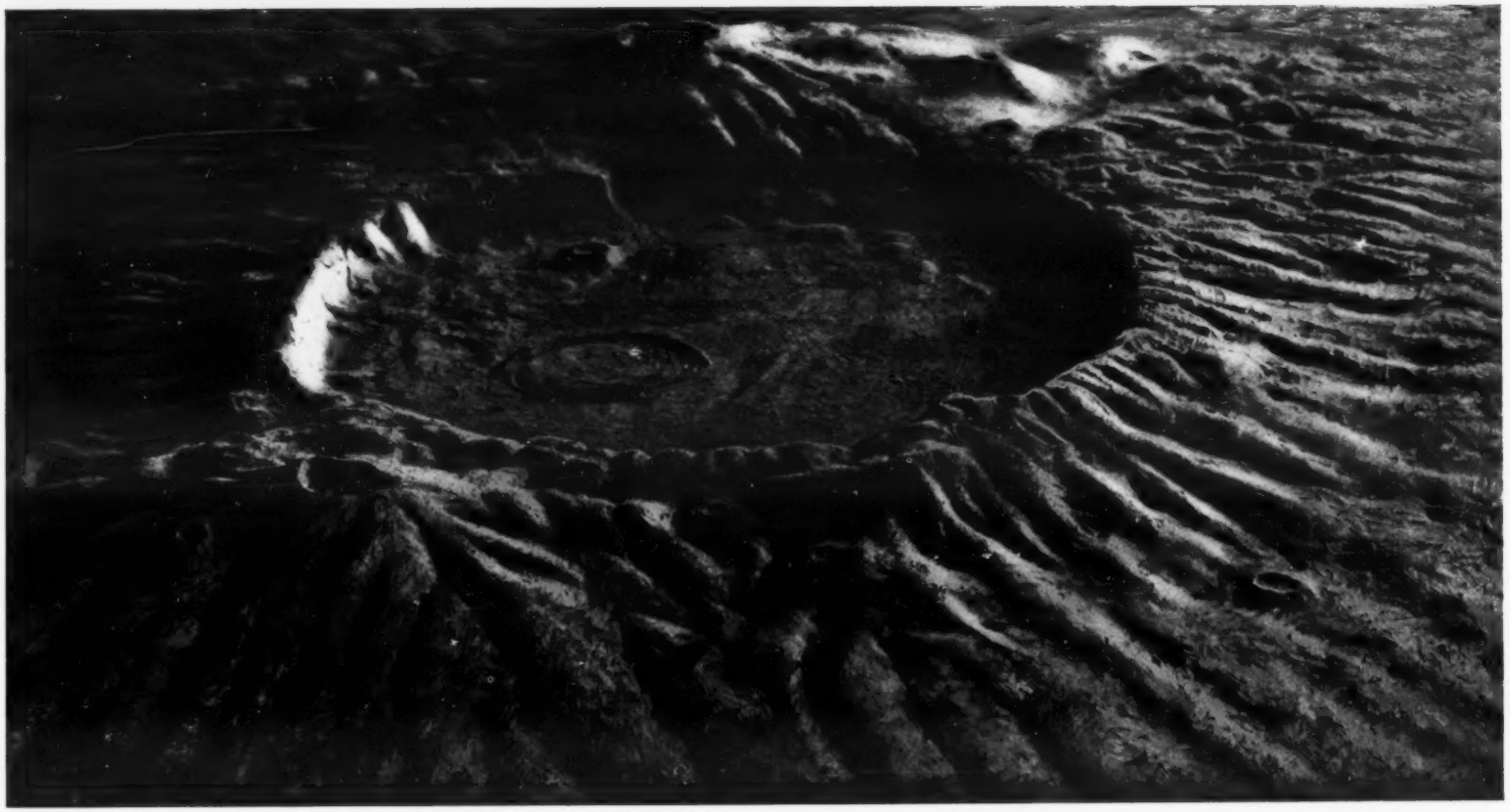
Looking north toward the outer edge of Ngorongoro crater.—This picture is virtually a panoramic continuation of the one on the opposing page, there being only a slight break in the vista. The horizon line is the crater edge proper, which extends nearly as far again to the right. Its outer wall, blanketed in dark green, is well defined from the rolling plains that rise very gradually to meet it.

Hartebeest, gnu, eland, and some of the smaller antelope, zebra, and lions roam these plains, while occasional rhino and elephant trek across them on their way to and from the forests of Ngoro

this tremendous hollow once a great volcano of molten lava and seething fire?

I leaned forward, still clinging tightly to the bushes; below me the forest-covered wall seemed to drop almost straight. I could view the entire inner wall of the crater with one sweeping glance: it seemed almost a perfect circle, its slight irregularity lost sight of in its magnitude. The two volcanoes, Ololmoti and Oldeani, rested like sentinels on its sides, just back from the rim. The rim itself is remarkably even, maintaining its almost perfect edge without a single break or outlet. The floor, which totals about 110 square miles in area, lay perfectly flat and treeless, except for two small forests near the south and east walls.

The areas of differently colored grasses made a patch-work quilt that spread over the entire floor. Way to the west was a shallow mirror-like rain pan bordered by white shores of volcanic earth that dried and baked in the hot sun wherever the waters had receded through evaporation. The floor, which is 6000 feet above sea level, lay 2000 feet below us. Everything was dwarfed: the rain pan, which seemed so small, is miles in circumference; and the tiny acacia forests, that hardly intrude on this great surface, are so large that in them one could easily get lost. Dense forests that cover the outer slopes and rim jut down in great spurs through the steep valleys of the inner walls of the crater until their apices nearly reach the base. Mirror-like patches, fringed with vivid green, told where the level floor held smaller pans of water that nestled in beds of reeds. Way to the western side lay a small flat parasitic



RELIEF MODEL OF NGORO

The model, which was made by the author of the article, is orientated to the north. Ololmoti rests on the northern rim and Oldeani a little to the southwest. The rain pan, known as Lake Magad, in the southwestern area varies considerably in size, depending on the rains, which quickly swell it. The only parasitic cone within the crater is shown just beyond the lake. In the northern section can be seen the rounded hills that blend into the rim.

The large reed bed that shelters the hippopotamuses is seen to the right as a dark area, which also includes one of the acacia forests. The other forest is seen as a dark area just over the southern rim. With the exception of these, and a reed-bed area between the rain pan and the parasitic cone, the crater floor is a great, flat plain

cone—the only one within the crater walls.

Local showers and morning mists above the forests are the main source of water supply, if a gusher spring be excepted that comes boiling from the ground on the eastern side and feeds a large swamp in which a herd of hippos make their home. No streams flow in or out of the crater except two minor ones that come hidden through deep ravines, more as a percolation from the rain forests above than as an outflow from any reservoir of supply.

Minu'e specks that covered the floor of the crater like pepper sprinkled on a plate, proved to be—through the glasses—its sheltered herds of game, that extended more or less concentrated, yet unbroken, over its entire area, suggesting a great zoo, or an immense cattle ranch, where there is room and feed for all.

From where I stood to the opposite rim was about twelve miles; the rim itself is some thirty-five miles in circumference. I gazed and wondered,—wondered at this, probably the greatest crater in the world, until I fancied I could picture it a great molten mass of crackling, moving lava. What a fire pot it must have been! And at night how dazzling must have been its uncanny beauty, with great clouds hanging over the molten mass, blazing reds and pinks reflected on their billow forms, lighting the sky for miles around, and, when seen from great distances, appearing like a floating setting sun in the blackness of the firmament!

After feasting upon the sights from above, we descended by a broken path that went zig-zag down the precipitous rocky walls as best it could, winding in and around big trees that clung to the sides with difficulty by their tenacious roots. Stepping down over the uneven rocks was tiresome indeed, and it was a relief to arrive finally at the base, where there was level going.

As one looked up from the bottom, the walls seemed even higher than they did from above, and the expanse within greater than ever. Even then its size was not fully appreciated; something like an adequate conception of it was formed only as we trekked across one little corner of the floor. We walked and walked, and apparently were getting nowhere—making no impression on the great expanse. A given point seemed to stay right by us in spite of steady plodding. The more we walked, the larger the area seemed to grow. The floor lay remarkably flat; only occasionally was there the slightest undulation.

We marched to the southern side not far from the wall, and began to go upgrade over the broken ground of an old lava flow that had come down from Oldeani, resting near the southwestern rim. Farther along, almost at the base of the wall, we camped on a little flat table-land by a small stream of fine cool water. Here we obtained a clear view of the whole crater floor from within: just in front was one of the two acacia forests. We looked right over this and could see how little it really is when compared with the great expanse of the crater.

Straight across to the north, the wall is less distinct: it rises in a series of low rounded hills that blend into the slopes of the volcano Ololmoti. These hills appear to be the results of a series of lava flows from this outlet or, again, they may originally have been smaller cones that through long erosion in time took on the form of hills. Over the floor to the northeast and the northwest are scattered a few volcanic rocks that break the otherwise

seen as a dark area just over the southern rim. With the exception of these, and a reed-filled area between the rain pan and the parasitic cone, the crater floor is a great, flat plain

304

First view of the crater basin obtained from the southeast wall.—The lighter areas are the dried mud flats left exposed by the receding water. Darker areas in the foreground are the grass patches and reed beds. The opposite rim is twelve miles distant

Looking north across the crater floor from the author's camp at the south side.—Ololmoti is visible in the distance. One of the two acacia forests is seen in the foreground

Game within the crater.—It is estimated that there are 50,000 or more wild animals in this great natural zoo

Scattered volcanic rocks on the crater floor.—The one in the foreground is well worn, having long been used as a "rub rock" by the animals

Northeastern wall of the crater

Looking from the northern rim of Ngoro up the southeastern slope of Ololmoti

exceptionally smooth surface.

The slopes that extend upward from the crater floor are covered with a rank bush growth, which gives way to forests as the upper edge is approached. On the top, open glades and grassy rolling country are interspersed with patches of acacia and other big timber until the slopes of the two big volcanoes are reached. There the tree growth is suddenly replaced by a solid thicket of small bamboos, from fifteen to twenty feet high, that extends clear to the peaks. These bamboos are the home of buffaloes, rhinoceroses, and bush antelopes, as well as of many monkeys.

The sides of the crater are very steep and even when entering or leaving by one of the three or four possible routes of approach, a stiff zig-zag climb is not to be avoided. The inner surface of the wall is so eroded that only in one place, and there very faintly, can one discern through the growth of vegetation that covers it, any sign of stratification of the old overflowing lava.

On the floor the grass, growing luxuriantly from the volcanic soil, has been cropped short by the countless herds of wildebeest, gazelle, and many other kinds of antelope as well as zebra that move about on every side. Occasional beds of reed, like our cat-o'-nine tails, are the only vegetation breaking the even landscape. At only a short distance the dancing heat rays as they rise make these growths inconspicuous and one passes through them, only to continue over the undifferentiated plain with its herds of game.

There were not the usual series of game trails going definitely to various feeding grounds or water; instead the terrain was tramped over like a barnyard by the herds that tread it aimlessly as they feed in all directions.

A Thompson's gazelle fawn "in hiding" on the open plains.—Left by its mother while she goes off to feed, it instinctively lies perfectly flat and without the slightest movement. Its immobility and color make detection of the animal difficult. Only the fact that Mr. Clark came very near stepping on it revealed its presence to him.

The photograph was taken at about three feet distance but the fawn made no attempt to run away, trusting to the last moment in the possibility of escaping detection

The author's safari trekking across the level crater floor with the northeastern wall rising in the distant background

The reed beds, with the bush and long grass that border the forest, just off the floor's edge, are the haunts by day of the many lions that steal forth at night to prey upon the abundant herds. These retreats also shelter the reedbuck and the little duikers as well as the numerous hyenas and jackals, that finish up the leavings of the lion's kill and pick up the scraps that lie strewn about.

Herds of hundreds of the little Thompson's gazelle that blend so well into the color of the ground, suddenly appear right before you as if they had been conjured out of the air, and scatter, on your approach, only to blend and disappear again right before your eyes. Eddies of wind pick up the light volcanic dust and carry it along in tall vertical twisted columns across the level ground or blow it up in dust clouds and silhouette black wildebeest that had escaped your notice.

It is the exceptional natural conditions that have made possible such a great concentration of game and that have assured its perpetuation. Into this perfectly sheltered basin with its high rocky walls—where the nights are cool and the days warm, where the grazing is perfect and water is relatively plentiful—game has drifted from the more arid country around. It is undoubtedly from the surrounding great plains that these animals have come, lured by the scent of sweet grass and waters, drifting in a few at a time and increasing under ideal conditions; while others less fortunate in their selection, drift northward to the grassy but less-watered area of the Athi Plains and pass leisurely through the great southern game preserve and into the hunting fields of British East Africa.

The expanse of the crater is great, and the animals have no reason to leave. More come from without while there is a natural increase within. Estimates give the game within the walls of this

One hundred fifty blacks of the Mbugwea tribe were used in the transportation of the supplies

great natural zoo as 50,000—personally, I believe there are more—but what difference do a few thousands make when there are so many animals that you cannot even estimate them, and the great herds are so big that the distant ones fade into the "blue" before your vision can reach the end!

Birds of many kinds abound in the pools of still water, that remind one of the great aviaries of the zoos into which have been crowded the birds of the world.

Perhaps nowhere in Africa is there such a concentration of lions: on one morning, just at the break of day, a pack of seventeen was seen making its way back to cover after a night of raiding, and at another time eleven were observed entering a bed of reeds for their daytime nap. Leopards and cheetahs, and the smaller beasts of prey, gorge themselves and live in contentment until their next mealtime, yet make no impression on the great herds that breed faster than their enemies can take toll. Elephants and their bush companions, the treacherous buffalo and the powerful rhino, are present in moderate numbers in the virgin forests that clothe the crater walls. Even the little animals contribute their share to the multitude, and in great areas the ground moles are so numerous that they honeycomb the earth, so that with every other step one breaks through into their tunnels, or stumbles over their little mounds.

Ngorongoro is the greatest extant natural zoo, and should be set aside as a preserve. To see this—probably the greatest of all craters in the world—is a wonderful privilege, and to see it in association with its thousands of beautiful birds and beasts, for the protection and perpetuation of which one would like to believe it was created, is something that seems almost too marvelous in these days when the world is being stripped of wild life.

*Photograph by Irving K. Taylor*

A HERD OF MORE THAN TWO HUNDRED ELEPHANTS

This snapshot was obtained in March, 1921, in the Nile-sudd south of Lake No. One can hardly imagine the impressiveness and awe of such a spectacle in the wild. For ages vast herds have assembled toward the end of dry seasons to migrate from scorched, arid places and devastating grass fires into regions offering safety and more abundant fodder. The bulk of the herds is made up of young animals, often very aggressive and high-spirited. This has given rise to tales of the distribution of the pygmy elephant over the greater part of western Africa and about the edges of the West African rain forest.

No more stately and venturesome rovers could be imagined. Their favorite haunts are undoubtedly the wooded parklands, but luxuriant forests and tree-dotted plains prove equally attractive and like the edges of deserts, the snowfields of equatorial peaks also tempt them. The African elephant, unlike the Indian, is intractable, and there is no chance that it will survive as the servant of man

# The Vanishing Wild Life of Africa[1]

By HERBERT LANG

Associate Curator, African Mammals, American Museum

EVER since white man set foot upon African soil to make his own trails across the trackless jungles, the world has been astonished by tales of an apparently inexhaustible wealth of game.

As one of the oldest of the large land masses Africa is remarkable for its compactness and the lack of indentation in its coast line. A comparatively great stability, with relatively slight fluctuations of the land area since Tertiary times, must have assured an exceptional continuity of favorable breeding grounds for its marvelous array of beasts. Here was the ideal setting for the evolution of a unique fauna, which fossil records indicate was essentially vigorous and more truly African than had formerly been believed.

Furthermore, as a result of its practical isolation, Africa offered unwelcome competitors among the mammals little chance for invasion. Except in the Mediterranean regions man himself was not able to people successfully the vastnesses which proved so inhospitable to him. Only after the introduction of satisfactory staple foods from other continents—an accomplishment credited chiefly to the Arabs and the Portuguese—did his scattered settlements in the wilderness of the great forests flourish.

Thus for many centuries Africa remained a paradise for vast herds of game. In no land has nature offered such an impressive aggregtee of mammals. Countless indeed were their numbers. Gigantic brutes, ungainly and cumbersome, mingled with the most graceful and fleet of tropical wanderers. Stubborn brutishness and unexcelled virility in some were contrasted with defenselessness in others. Beasts of prey, powerful, strong, and stealthy, singled out the weaklings and the careless, to whom less chance was thus given to dispute the leadership of those that alone would insure a vigorous race.

When the Roman triumphs had achieved the acme of cruelty and fastidiousness, the victorious leaders of stalwart legions could still add to their glory by displaying in the arena African beasts either so wild or so imposing as to drown the popular dissatisfaction. To think of five hundred lions and twenty elephants in a single orgy of savage destruction almost surpasses the capacity of our later-day imagination, yet that is the inauguration record of Pompey's theater in 52 B.C.

Hundreds of years have passed, exacting their heavy toll. Northern Africa, long the part most accessible to Europe, has lost its gigantic mammals. The hordes of despoilers would find much of it a desolate wilderness today. With this in mind, the admirers of nature at her best and other right-thinking men and women now look with alarm upon the rapid decimation and threatened extinction of the game animals in the remainder of Africa.

South of that fiery furnace, the Sahara—the greatest continuous desert in the world— lies the Ethiopian region of zoölogists. It extends more than three thousand miles from the north

[1]Photographs, with the exception noted, by the author

to the Cape of Good Hope in the south, and even for a greater distance from west to east across Senegal to the Somali coast. The fairly uniform warmth of the climate throughout virtually the entire length and breadth of this region favored the development of free-roaming animals. The margins of the raging sea and the desert wastes were the only limits to their realm. No bleak high mountain chains barred the way. Only four glacier-bearing peaks arise like snow-capped islands from the blue equatorial haze. At certain seasons their foothills offered a welcome change from the torrid sun that scorched the plains. Equally welcome were the lofty hills and the invigorating freshness of the high plateaus in the south, east, and north. Thus nature extended a matchless domain to the throngs of grazing and browsing creatures.

Roughly speaking, there are but two kinds of abode in all the land: the grass-covered regions, or savannas, and the tropical forests. Both offer an ample variety of food and shelter: their differences depend chiefly on the amount of rainfall and humidity. Some animals, like the elephant and the buffalo, can live in the dry savanna as well as in the humid forest. Others, like the rhinoceros, the giraffe, and the zebra, and most of the antelopes are at home chiefly in the grasslands, which include about two-thirds of the entire Ethiopian region. On these open, sunny spaces, sprinkled over more or less with bushes or trees and dotted with park lands between the hills and ravines, Africa's chief wealth of game had its stamping ground. Of the nearly one hundred kinds of antelopes, varying from the size of a hare to that of a bull, each lived in its peculiar sphere.

A vitally different area is the West African rain forest, an equatorial belt about 400 miles in width and 1800 miles in length. In this steaming hot complex, with its lofty canopies mostly one hundred fifty feet above the ground, seasonal changes are but slight. The dense vegetation makes gregariousness here as impracticable as it is advantageous on the plains.

For days and weeks one might travel in these forests and catch but few glimpses of its wild denizens. In striking contrast with the level plains, the hiding places in the tall and luxuriant forest are multiplied beyond measure. Elephants and buffaloes in small troops, the huge, black, forest boar, and the most beautiful of all pigs, the red river hog, though lost to the eye, can be heard as they seek safety in the depth of the jungle. Of the bands of monkeys, occasionally chattering and gamboling, only an inquisitive old male dares to scrutinize the intruder. With a saucy, cocksure air he puckers his face and contemptuously dismisses the idea of escape. There are antelopes, great and small, porcupines, squirrels, and an array of smaller mammals. Chimpanzees herald the morning with loud calls and shrieks.

On the whole, however, these forests are a far too unsatisfactory scene of operation for the white hunter, who must linger long to reap his reward. The uncongenial climate and the difficulty of getting about rob the sport of any enjoyment. In such a retreat wild life in general would long be safe if gun and powder were not distributed among the natives.

But in spite of all these impediments nature is in danger of losing a few of her rarest mammals. In vain has she been able to hide and shelter them through untold ages. The white man has set

about rudely wrenching from her the last remnants that have survived from bygone days. Foremost among them are the okapi (*Okapia johnstoni*), the pigmy hippopotamus (*Chœropsis liberiensis*), the gorilla (*Gorilla*), and the chimpanzee (*Pan*).

The okapi is as rare as it is inoffensive, and being nocturnal is seldom seen. Its haunts are confined to a small portion of the gloomy West African forest, a narrow strip about 700 miles long and 140 miles broad, in the hilly regions of the headwaters of the northeastern affluents of the Congo.[1] In spite of its relatively large size, about that of a mule, the okapi was not known to the outside world until 1901 when it was discovered by that distinguished African explorer, Sir Harry Johnston. Instead of being a forest zebra—as was for a while the impression, based on the striped pieces of skin secured—it proved to be a short-necked giraffe, small-eyed, and with a delicately modeled deerlike head. Its dark brown velvety coat, with whitish stripes chiefly across the limbs, was highly prized by the natives for superstitious reasons, and the skin of its hind limb, with the striking pattern, would purchase a wife. Only a powerful chief was permitted to sit upon the hide or use the pretty parts as ornaments.

So elusive a quarry was in no danger of being successfully hunted by the white man. Its rarity, however, and its peculiar fame made him place so high a premium upon a good skin that the magnificent hermit creature has been hounded by the natives into its most distant retreats. If equally enticing rewards were made to the chiefs to protect the okapi in their sphere, the most remarkable of large African mammals might be able to hold its own. Policing its habitat is quite out of the question, but the characteristically marked skin is so easily recognized that confiscation would not be difficult and would help in assuring the survival of this interesting creature. It seems a pity that an animal that has weathered the storm through probably millions

A young male okapi (*Okapia johnstoni*) at Niapu, northeastern Belgian Congo.—Just captured, he is bleating like a sheep for his mother, disproving the belief that muteness is the unalterable fate of the giraffe family

of years should be wiped out within a few decades after being recorded in the annals of science.

Were it not that the pigmy hippopotamus has been able to hide in the depths of miasmal swamps in Liberia, it might long ago have followed in the footsteps of the Madagascan form, now known only as a fossil. Major Schomburgk was the first white man to study a pigmy hippopotamus in its haunts. This was in July, 1911, and he subsequently captured several specimens alive. Three of these fine examples, exhibited in the New York Zoological Park, responded to the excellent care received there by adding to their number.

[1] Lang, Herbert. 1918. "In Quest of the Rare Okapi." *Zool. Soc. Bull.*, New York, XXI, pp. 1601–14, 11 photos, map of distribution.

From Schomburgk we learn that instead of making good its escape by continuous diving, the animal seeks refuge in the dense forests bordering the river. It is fortunate that the inhabitants of Liberia hold it in high fear, and its rather ugly hide is not a desired trophy. These circumstances have perhaps contributed as much toward its preservation in the past as legal regulations made in its behalf will, it is hoped, aid it in the future.

The gorilla, the largest of the manlike apes, is fortunate in having lately been championed by those interested in its protection. Of the two widely separated areas in which the animal is still to be found, that of the western race (*Gorilla gorilla*) is by far the larger. It extends from the hilly sections of Cameroon southward along the coast into the northern border of the Belgian Congo and eastward to the Sanga River. The last remnants of the central African mountain race (*Gorilla beringeri*) have been holding out in the forested volcanic peaks north of Lake Kivu and northwest of Lake Tanganyika. The reopening of the Daressalaam-Tanganyika railroad in recent years, together with the introduction of Ford automobiles, has made access to that country so easy that the gorillas have been placed in danger of rapid extermination. Mr. Carl E. Akeley, who made valuable observations and took the first moving pictures of these apes in the wild state, has made persistent efforts to have the Belgian authorities set aside the gorilla haunts as a sanctuary, and these efforts should pave the way for their eventual survival.[1]

Consolation is found in the fact that some of the huge primates, like the chimpanzees, appear to be of a rather vigorous race, as the family groups of from eight to twenty or more members would indicate. Contrary to general statements, they reach maturity rather early, somewhat in conformity with the natives living in the same regions. Parenthood is assumed apparently at ten years of age or less. According to data published by Doctor Blair, of the New York Zoological Society, in the case of the first chimpanzee born there, the mother Suzette was then in about her tenth year, weighing 130 pounds; the father, Boma, in about his eighth, weighing 145 pounds. Other most important observations in this respect have been made on chimpanzees at the home of Senora Rosalie Abreu, owner of the "Quinta Palatino" estate at Havana, Cuba, where they have been raised to the third generation. There the apes seem to have a pronounced preference for monogamy.

It is highly gratifying that the French government has now issued ordinances prohibiting the capture, sale, and exportation of live chimpanzees in Africa. Should the Belgian and English authorities join them, and extend this policy to include the gorilla, and stop the shooting and exportation of dead specimens as well, it should save from a speedy death warrant the great African apes in which man has a deep and justified interest.

One might think the smaller monkeys would be safe from wholesale destruction except in the neighborhood of settlements, where they frequently cause havoc among crops. But the power of the clink of gold spurs man on. In the year 1892, no less than 188,000 skins of the *Colobus* monkey were exported from the Gold Coast.[2]

[1]Akeley, Carl E. 1923. "Gorillas—Real and Mythical." NATURAL HISTORY, Vol. XXIII, pp. 428–47.

[2]Buxton, E. N. 1903. "The Preservation of Big Game in Africa." *Journ. Soc. Arts*, London, Vol. LI, p. 576.

How mercilessly their annihilation was carried on is best proved by the fact that five years later only 1067 skins figured in the records. The silky-haired, black-and-white mantled skins had become the fashion. Thus two of the most strikingly beautiful forms of West African forest monkeys (*Colobus satanas* and *C. vellerosus*) were cruelly hunted down. In Eastern Africa their near relatives with the magnificent, generally white tail brush would probably have been wiped out completely had legal protection not come to their assistance in the nick of time.

A young female *Colobus abyssinicus ituricus* from Faradje, northeastern Uele, Belgian Congo. On account of the beauty and consequent market value of the long silky black-and-white pelt these monkeys were slain by the thousands until protective measures were taken in their interest

Often it happens that relatively small and obscure nocturnal forms, hardly represented in any museum, become the object of intense pursuit. From a range of high hills along the Gold Coast, with deep gorges and ravines covered with almost impenetrable bush, no less than 200 pelts of the rare spiny-tailed flying squirrel (*Anomalurodon pelii*) were brought down by two native hunters in about a month's time.[1] Yet their silky, chinchilla-like fur is absolutely worthless, the skin being extraordinarily thin and fragile.

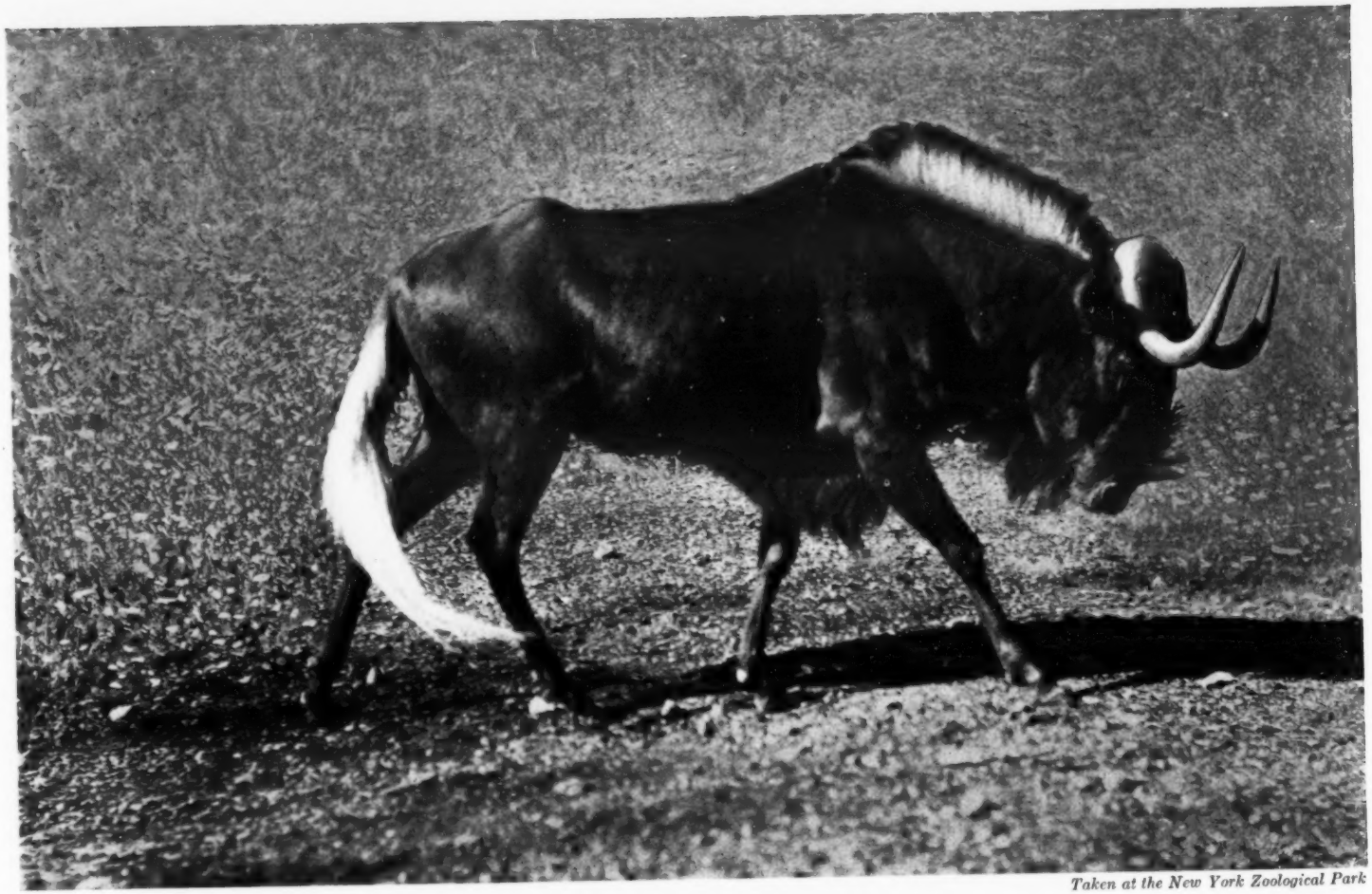
To return to the real hunting grounds of big game, the savanna country and wooded patches bordering the great forests, there sad havoc has been wrought. Attractions beckoned from so many sides that, the climate permitting, the white man was not slow in heeding the invitation. However, the influx of settler and hunter is not to be held solely responsible. India furnished a splendid example of the survival of herds of game during centuries in the midst of a dense population. But now transportation facilities have lessened the hazards of travel and the frightful advance in the construction of firearms has made even the most dangerous hunting a sport to be carried on recklessly.

In one of the previous numbers of this journal[2] citation is made of a paragraph by the author to the effect that at least two of the larger African mammals have been completely done away with. The last of the quaggas (*Hippotigris quagga*), a nearly unstriped South African zebra, was killed in 1878 in Orange Free State. Of the blaubuck (*Egocerus leucophæus*), apparently always scarce, the last record dates from about 1800, when the animal was reported from the Swellendam district of Cape Colony. Only a dozen specimens of the quagga and five of the blaubuck have been preserved in the museums of the world.

There is a long list of hard-pressed sufferers in South Africa which deserve to be kept alive. Perhaps the same pride South Africans take in their

[1] Adams, W. H. 1894. "On the Habits of the Flying-Squirrels of the Genus *Anomalurus*." *Proc. Zool. Soc. London*, pp. 243–46.

[2] Osborn, H. F., and Anthony, H. E. 1922. "Can We Save the Mammals?" NATURAL HISTORY, Vol. XXII, pp. 398–402.



*Taken at the New York Zoological Park*

**THE WHITE-TAILED GNU (*CONNOCHÆTES GNU*)**

The "wildebeest" of the Boers is the strangest-looking of all the antelopes. Among the ruminants, that large class of shiftless wanderers, none has excited more admiration than this animal with its equine body, menacing buffalo head, shaggy mane, and long white horselike tail. Yet in less than fifty years the apparently inexhaustible herds that formerly populated the plains of Cape Colony have been reduced to a few troops living on farm lands

achievements in developing the country will manifest itself in granting the remnants of big game a definite leasehold, free from all future encroachments. The four hundred mountain zebras (*Hippotigris zebra*), the few bontebuck (*Damaliscus pygargus*), blesbuck (*D. albifrons*), and the white-tailed gnu (*Connochætes gnu*) are on the verge of extinction. But the most magnificent of all antelopes are those pursued hardest. The larger kudu (*Strepsiceros strepsiceros*), the nyala (*Nyala angasi*), the sable antelope (*Hippotragus niger*), the roan (*H. equinus*), and a few others in different regions, need more adequate protection, especially when they answer the requirements of a sportsman's trophy. A case in point is the newly discovered Angolan race of sable antelope (*H. niger variani*) with horns measuring on their front curve as much as sixty-four inches.

The abundance of the beautiful springbuck (*Antidorcas marsupialis*), at the beginning of the last century would seem well-nigh unbelievable were it not for Gordon Cumming's account, amply corroborated by others. For two hours he saw vast legions of these animals streaming through a neck of the hills in unbroken phalanx. The hillsides were covered "not with herds but with one mass of springboks." As far as the eye could strain, the landscape was alive with them. "Some hundreds of thousands were within the compass of my vision" until they faded into a dim red mass of living creatures. Flocks of sheep becoming intermingled with them were swept along without hope of escape. Even the lion may thus be entrapped. Such inspiring sights are of the past. Springbuck can still be shot for sport, but so typical a South African animal deserves pastures offering a secure refuge.

One of the worst of fates has been meted out to the square-lipped or "white" rhinoceros (*Ceratotherium simum*). Extremely common in suitable sections of South Africa in 1817, when it was first made known by Burchell, this rather stupid, quiet beast was recklessly butchered from the very beginning. During the course of a day's trek from fifty to one hundred could be sighted. The shooting of ninety rhinoceroses, most of them of the square-lipped kind, in one journey, was an event to be proudly heralded by two famous sportsmen; another game hog killed sixty, considering it a feat to be recorded in the annals of hunting. Today perhaps not a dozen are left, the very preserve set aside for them having been opened to slaughter. Between the two Umfolozi rivers in Zululand, their last stand, they have little rest, for the farmer covets the land and their ultimate survival seems extremely doubtful at the present time.

Of the Upper Nile race of white rhinoceroses (*Ceratotherium simum cottoni*) several thousand were still left in 1910.[1] But recent reports as to their status give cause for alarm. Unless drastic measures are soon taken to prevent traffic in the hides and horns, this huge representative of the Pleistocene age will shortly be extinct.

In former days it ranged to the extreme north of Africa as shown by fossil records and was even contemporaneous with Neolithic man, who engraved its image on the rocks.[2] It is difficult to understand how such splendid examples of nature, practically harmless though possessed of formidable weapons, should suddenly be brought to the verge of extinction.

[1]Lang, Herbert. 1920. "The White Rhinoceros of the Belgian Congo." *Zool. Soc. Bull.*, New York. Vol. XXIII, pp. 66–92, 31 photos, 1 map, 1 text figure.

[2]Lang, Herbert. 1923. "Recent and, Historical Notes on the Square-Lipped Rhinoceros (Ceratotherium simum)." *Journ. Mammalogy*, Vol. IV, p. 159.

Among the bigger game the most distressing losses have been inflicted upon the elephant and the hippopotamus. A continuous toll has been exacted by armies of hunters. Literally hundreds of sportsmen annually visit Africa from every point of the globe. They will no longer find the great tuskers nor the thousands of river horses. Elephants have no opportunity to grow old. Governments have reaped the benefits of increased income derived from taxes on permits and the exportation of ivory, and have thus consented to their doom. And this has gone on in spite of all assurances to the contrary.

Young bull of the square-lipped or "white" rhinoceros (*Ceratotherium simum cottoni*) near Vankerckhovenville, northeastern Belgian Congo.—Close approach arouses in even so stolid an adversary the signs of a charge, usually preceded by the twisting of the tail. The value of the horns and the relative lack of danger with which so large an amount of meat could be secured brought about the doom of the South African race of this giant even before civilization reached the fields it roamed

Among the causes of destruction of wild life in Africa the natural agencies, however severe, have proved to be relatively unimportant, chiefly because of the infrequency of their occurrence. The uniformly mild climate is accompanied by no such seasonal inclemencies as the habitual wintry rigor of colder regions. Even violent tornadoes and destructive hailstorms are few and far between. In ordinary dry seasons, the game is wont to repair in great numbers to more satisfactory pasturage or to a few isolated waterholes. The yearning of the animals at such times to quench their thirst eliminates much of their habitual wariness. On such occasions game photographers, hiding in "blinds," have made the most successful pictures. True it is that destruction of thousands upon thousands of game animals by drought has been recorded, but only as extremely rare occurrences during a period of consecutive dry years. Such a calamity, being local at most, does not influence the general

status of the continental herds, though, judging from Gregory's account,[1] acres may be covered with the bleached bones of the victims.

The increase of drier areas in Africa, especially in the north and south, as a result of gradual desiccation, has been frequently cited as an important factor limiting the distribution of some of the mammalian fauna. The data so far advanced seem to point toward a change of climate causing drier conditions and especially a more intensive drainage. The result is well exemplified by the dry areas formerly covered by lakes Chad and Ngami. Perhaps many of the migrations of great herds of game, as described by the earliest explorers, were due to the setting in of such modifications in the regions cited.

A very encouraging contribution toward the preservation of game animals in Africa is the long list of scientific achievements in curbing the rapid spread of various diseases. The successful use of immunizing sera is one of the noteworthy results. Rinderpest, formerly considered the most deadly of the infectious scourges, filled with dismay and terror those interested in wild life, but it is now fairly well under control. Apparently of Asiatic origin, it reached Africa by way of Egypt. As usual it was introduced by infected live stock and proved to be extraordinarily virulent in its swift progress. In about fifteen years it traversed the entire length and breadth of the continent. From 1886 to 1898 it caused the most frightful losses in game and cattle alike, generally ninety per cent of the animals attacked succumbing within a week. The difficulty and uncertainty of diagnosis is chiefly due to the fact that incubation is latent for the first few days. Intense fever, swollen mucous membranes, the development of small papular ulcers, and extreme prostration are common indications. In the early days rinderpest raged unchecked, but future catastrophies are improbable as its occasional outbreaks are now quickly localized and the heavy mortality much reduced. The most hopeful point of all is that in less than fifteen years African game without exception recuperated, especially in those regions where organized slaughter was stemmed.

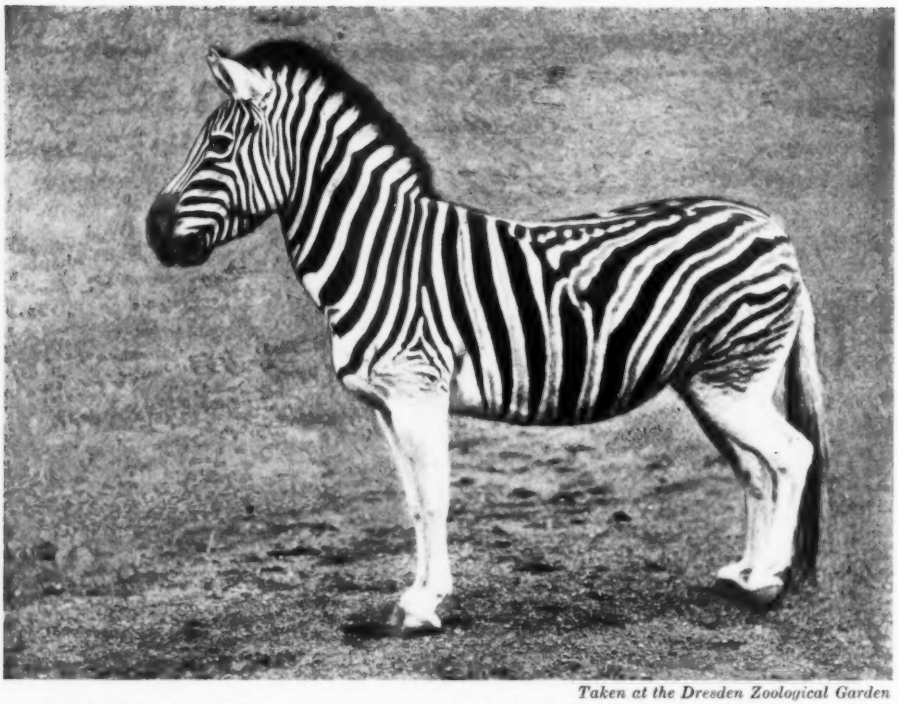
*Taken at the New York Zoological Park*

Formerly found in astounding numbers on the plains in the southern parts of Africa, the blesbuck (*Damaliscus albifrons*) now exists only on certain farms in the Orange Free State, Transvaal, and Bechuanaland

In 1891, when the ravages of rinderpest were greatest in East Africa,[2] buffaloes came down to the Tana River literally in thousands to die. A gruesome sight were the attending vultures and marabout storks gorged to reple-

[1] Gregory, J. S. 1896. *The Great Rift Valley.* London (John Murray), p. 268.

[2] Hobley, C. W. 1922. "The Fauna of East Africa and its Future." *Proc. Zool. Soc. London*, Vol. I, p. 2.



*Taken at the Dresden Zoological Garden*

Burchell's zebra (*Equus quagga burchelli*), the closest relative of the extinct quagga. This magnificent stallion was considered one of the last of its kind living in captivity in 1905

tion. Hardly any of the game animals escaped. Giraffes, and most of the antelopes, including waterbuck, eland, kudu, and bushbuck, as well as pigs and rhinoceroses, were victims. Apparently zebras, oryx, sable, roan, wildebeest, and hartebeest did not suffer in such numbers. Elephants and hippopotamuses apparently escaped unscathed.

Twenty-odd beasts were the sole survivors of many thousand head of cattle in northeast Kitui. The desiccated carcasses of those which fell were piled up like a wall outside the villages. Famine was the natural consequence for cattle-herding tribes such as the Somali, Suk, Masai, and Dinka. Rinderpest apparently reached the northeastern Uele in the early nineties, according to information supplied by Maruka, an intelligent native chief of the Logo tribe at Faradje. He told me in 1911 that when the disease reached his country and killed nearly all the cattle, the hook-lipped, black rhinoceros (*Diceros bicornis*) that feeds on bushes died out and never appeared again. The square-lipped, or white, rhinoceros (*Ceratotherium simum*), however, though greatly decimated like the buffaloes, elands, wart hogs, and other game, became sufficiently numerous once more, and for a time held its own, only to be nearly wiped out subsequently as the result of a native uprising during the war. From this it might appear that the two kinds of rhinoceroses formerly shared the range in the Uele, where now only the square-lipped one is known. The black rhinoceros is still common in the Shari-Chad region.

Anthrax, another of the sporadic infectious diseases often fatal to game

and marked by nasty ulcers and intense prostration, is to a large extent deprived of its danger nowadays by Pasteur's method of protective inoculation through anthrax serum, which offers an immunity lasting nearly a year. The last serious outbreak[1] occurred in 1905, killing several thousand head of game, chiefly Coke's hartebeest on the Athi Plains in Kenya Colony. Formerly such disastrous visitations aroused the hostility of the settlers against the game, which they held responsible for the spread of the disease among their own live stock. In the face of such opposition one can realize what a boon it has been to the game that the disease is at last well in hand.

Strange to say, there are scourges which have really served Africa's game as a protection. The formidable diseases borne by tsetse flies, in conjunction with malarial fever and a host of other afflictions, have hindered most of the white man's efforts to establish his home and take over large tracts of the country. There is no underestimating the really important rôle played by tsetse flies, chiefly *Glossina palpalis* and *G. morsitans*, which occur in a broad belt across most of tropical Africa.[2] They are the well-known carriers of a fatal virus, the former species transmitting the dreaded human sleeping sickness, the latter that of "nagana," or trypanosomiasis, a similar infection in cattle. Inoculation generally takes place as an incidental result of the flies feeding on or sucking the blood. Whenever they sink their mouth-parts into the blood vessels of their victim, the trypanosomes or flagellate protozoan parasites they carry may enter its system and cause terrible ravages there. At present two of these parasites are known to infect man in Africa—*Trypanosoma gambiense* and *T. rhodesiense*—but several others produce disease in animals. Apparently all African game, including the zebras, though not free from the germ, have become immune to it. It has been held that, acting as the chief reservoir of the virus, the game may indirectly become the most dangerous source of infection. But judging from experiments and observations the probability is great that there are other channels assisting the spread of these diseases. Unfortunately the cattle, though as a rule not affected by the parasites causing human sleeping sickness, readily succumb to those causing "nagana." The impossibility of raising live stock in all regions so infested becomes a well-nigh insurmountable obstacle to effective colonization by the white man, inasmuch as it prevents any extensive agricultural exploitation. Of domestic animals, only goats and chickens are able to thrive under such conditions, though in the northeastern Congo dogs also appear to be immune.

Some years ago in certain of the regions most concerned, the indiscriminate destruction of all the bigger game was urged for the eradication of diseases due to trypanosomes. Only by so drastic a method, it was argued, could man and cattle be freed from the dreadful scourges borne by tsetse flies. For the game, the reign of terror came with overwhelming force. A cause that was apparently in the interests of humanity was able to enlist the frenzied support of the fanatic. The big game was done away with, but all to no avail. At present it does not seem possible to prove that no other repositories of the virus, for instance among the smaller mammals, exist.

[1] Hobley, C. W. 1922. "The Fauna of East Africa and Its Future." *Proc. Zool. Soc. London*, Vol. I, p. 2.

[2] Chapin, James P. 1922. "A Naturalist on Lake Victoria: A Review." NATURAL HISTORY, XXII, map of distribution and text figs. of tsetse flies (pp. 60 and 61).

A CARAVAN LADEN WITH EXCEPTIONALLY FINE ELEPHANT TUSKS

Hundreds of caravans like this one, that was organized by a well-known Hindu trader in Uganda, travel across Africa in every direction to the nearest shipping center. In fact, there are so many tusks taken each year that they would make loads for more than 40,000 porters. No better proof of the relentless and appalling slaughter of African elephants could be cited than the records of the importation of ivory in parts of Europe. In 1913 alone, Great Britain, Germany, and Belgium received tusks weighing 2,592,073 pounds at a value of about $10,368,292. This one year's massacre amounted thus to about 63,220 elephants, allowing 41 pounds of ivory apiece. The figures are practically the same for each year of the decade preceding.

As a matter of accuracy it should be stated that the above computation contains also Asia's contribution of ivory, which, however, totals less than 2 per cent; and that certain limited amounts of ivory may figure more than once in the import records, owing to sales between the three countries under consideration. But this is more than compensated for by the fact that much larger amounts of ivory for which no exportation figures are available go direct from Africa to the United States, France, Italy, Spain, Turkey, Persia, India, China, and Japan

It may be interesting to state that Doctor Roubaud of the Pasteur Institute in Paris, one of the foremost investigators of human sleeping sickness, was led, as a result of his exhaustive studies in the field, to propose, as a means of combating the disease, the increasing of the number of domestic animals about the village. These would then attract the tsetse flies in preference to man, who might thus more easily escape infection.

One of the latest outbreaks of savage and utterly useless carnage of game occurred in 1920 in Zululand, its object being to make the country "fly-proof" for the cattle. Like the massacre of the Addo Bush elephants in 1919, this wholesale butchery was officially authorized. Since the drive included many inexperienced hunters, much game was wounded and some scattered over all the country, without accomplishing the result desired.

The many discussions as to the possibility of eliminating tsetse flies by the removal of big game seemed to have found satisfactory support when conditions were examined in regions where rinderpest had been most severe. But many experienced observers, among them Sir Alfred Sharpe, maintain that in certain parts of Africa the "nagana" tsetse fly (*Glossina morsitans*) is found where there is absolutely no game.[1]

We cannot help but admire nature's peculiar ways. Had it not been for such diseases, much of eastern Africa and parts of Angola and the Sudan might long ago have become a white man's country. Of course it would then have been swept as clean of game as the populated parts of South Africa.

The most hopeful agencies in protecting wild life in Africa are the game preserves. They should be set aside as permanent sanctuaries, free from all tampering through political whims. Inclusion of suitable and sufficiently large areas that border on the natural range of wild animals is also imperative to ward off inbreeding. The interest and beauty of such preserves would in the future attract admiring visitors in as great numbers as hunters have been attracted in the past. Were there a united great nation in Africa, with all people acting in concert, perhaps the problems would not be so difficult.

It is encouraging that twenty game preserves, comprising nearly 200,000 square miles, are to be found scattered all over the continent, mainly in British territory. But the status of even perhaps the most important one, the Southern Game Reserve of Kenya Colony, is woefully unsatisfactory. It is used as a reservation not only for the wild animals but for the Masai natives, and their herds of cattle have preference over the game, large numbers of which, when a drought comes, have to move outside and are foredoomed. In 1910, according to Hobley, the zebra and hartebeest from this reservation, in their frantic search for water, marched into the town of Nairobi, regardless of man. The lions followed close in their wake and killed them nightly in the public square.

It is on such occasions that as many as twenty-three lions, as at Lukenya, and even more than thirty, as at Simba, have been seen together, as vouched for by Sir Frederic Jackson and Bronsart von Schellendorff respectively.[2] These huge felines do not ordinarily come together to hunt in packs, but do so in smaller family parties. Such large gatherings are exceptional and

[1] Selous, F. C. 1908. "Big Game in South Africa and its Relation to the Tsetse Fly." *Journ. African Soc.*, Vol. VIII, p. 129.

[2] The reader is referred to the article by Mr. Clark in this issue, who records seeing a pack of seventeen lions at Ngorongoro.

...ation. But this is more than compensated for by the fact that much larger amounts of ivory for which no exportation figures are available go direct from Africa to the United States, France, Italy, Spain, Turkey, Persia, India, China, and Japan
324

usually occur in connection with the shifting of game from one region to another.

How difficult it is to regulate abnormal conditions after man has disturbed the balance of nature becomes clear again when we read that Tanganyika Territory in the first half of the year 1923 paid a bounty for three hundred lions and eight hundred leopards. In one district alone the lions killed sixty-seven natives. During the war there was wholesale slaughter of game as food for the contending parties. Cartridges were not to be spent upon carnivores, unfit as provisions. The scarcity of game undoubtedly drove these carnivores, left unchecked for years, to attack the natives.

So dangerous were they in 1898 that they held up the building of the Uganda Railroad, but how many are there left today in the localities of their former abundance? During the Pleistocene the lions reached as far north as Great Britain and eastward over a large part of western Asia. Glacial conditions forced them southward with the herds upon which they preyed. Babylonian art points to their relative abundance and suggests that even then lion-hunting was a sport practised by the reigning class to secure the plaudits of the masses. In Africa the lion was once common everywhere except in actual deserts and heavily forested areas. Now it is extinct in South Africa south of the Orange River, throughout North Africa including most of Egypt, also along the mouth of the Congo and the coast of northern Angola. Needless to say, it is greatly decimated wherever the white man has established himself. The lion went even before the game on which it preyed. In Asia it is nearing actual extinction; it is said that only a few are left in the Gir Forest, Kathiawar, Bombay Presidency.[1]

The success that attended the sport of hounding lions, as practised by the late Paul J. Rainey in East Africa, was too far-reaching. Thereafter packs of dogs were not allowed to help in the decimation of the big feline. Kenya Colony could not afford to lose its lions by such swift proceedings, for they are its great attraction, making the country a Mecca for sportsmen, who spend thousands of pounds in the country. Powder and rifle, traps, poison, firebrands, and electric flashlights harassed these huge carnivores. From behind impregnable fences and walls, or from the security of trees or other lofty perches blazed the shots that spelled the doom of the prowling lions. These animals ran the risk of being trailed even when they dragged their kill under cover to hide it from vultures, marabout storks, and the rest of the hungry horde. They were not the raging despoilers. Any kind of meat, even of its own kin, the carcass of an elephant, as well as carrion, is palatable to the king of beasts. The same is true of leopards. Under the greatest difficulties they sometimes drag their kill up trees, not merely out of reach of famished hyenas and jackals but even out of that of the lion.

The international organization for safeguarding African game was definitely initiated by the convention of 1900, attended by all the powers owning territory in that continent. The essential features of efficient protection were thus passed upon. Game sanctuaries; closed seasons; the sparing of females, young, and the rare species; restricted export of the skins, horns, and tusks of certain forms; prohibition

[1]Faunthorpe, Colonel. 1923. "The Vanishing Lion of India." NATURAL HISTORY, Vol. XXIII, p. 524.

of particularly destructive methods, such as grass fires, pits, snares, and game traps, made up the list. These regulations were all designed to limit or prevent unjustifiable slaughter of game or otherwise to foster its welfare.

As elsewhere, however, conditions in Africa have changed since the war. The tide of destruction is far from ebbing. The sheer impossibility of policing such immense territories, often without the slightest financial aid, woefully lames all such legislative measures. Recent decades have furnished decisive proof that real results in African game preservation largely depend on winning active support for the cause among those living in and visiting Africa. The negro population is not, as a rule, as dangerous as one might expect from general reports. Their traps, snares, and mongrel dogs do much less damage than the iron heel of civilization.

The gigantic size of some of the animals and the uncertainty of their temper is one of the biggest obstacles the movement for African game preservation has to deal with. Besides devastating crops, elephants by merely walking over wooden bridges may cripple traffic, and giraffes may interrupt communication by breaking telegraph wires. Zebras stampede through the strongest fencing and endanger both crops and domestic stock. Rhinoceroses and buffaloes may become dangerous by their numbers. But all such local difficulties will find easy adjustment by wise and moderate regulations.

Posterity will be grateful to those who have helped create a sentiment in behalf of the preservation of Africa's wild animals. Prof. Henry Fairfield Osborn, president of the American Museum, espoused the cause many years ago. By his influence and encouragement much has been done, crystallizing into definite results. Dr. William T. Hornaday, director of the New York Zoological Park, has launched many forceful pleas. Lately, in coöperation with Dr. A. K. Haagner, president of the Transvaal Game Protective Association, he has sent out to the South African people a handsome and well illustrated pamphlet[1] on the vanishing game of that region, in which an eloquent appeal is made for safeguarding what still remains,—an appeal which one would like to see heeded not only in South Africa but throughout the continent.

*Taken at the New York Zoological Park*

The wild dog (*Lycaon pictus*) is distributed over the major part of the savanna region, where it hunts in packs of as many as sixty and is very destructive

[1]Hornaday, W. T., and Haagner, Alwin K. 1922. "The Vanishing Game of South Africa. A Warning and an Appeal." New York and Pretoria.

*Photograph by Herbert Lang*

ONE OF THE STRANGEST CHARACTERS OF THE BIRD WORLD

The common African honey guide (*Indicator indicator*) performs a useful but not unselfish service in conducting man to some hive it has previously located. How this bird came to know that man could be of help in obtaining the food it prefers is still a subject for conjecture, but through his willing aid the honey guide is often enabled to feast upon the bee larvæ, which it probably covets more than the honey. Whether the wax that *Indicator indicator* so often swallows also serves as food seems very doubtful. That the substance is beeswax is apparent from the way it melts on a hot knife blade, only to congeal again as the blade cools.

Birds of both sexes act as honey guides, but the female, in addition to this rather commendable habit, has the more questionable one of laying her eggs in the nests of other birds and thus of avoiding the responsibilities of motherhood. Although resembling our cowbird in this practise, *Indicator indicator* is a near relative not of this malefactor but of the woodpeckers. Nevertheless, it rarely if ever climbs about on the trunks of trees, preferring to perch on twigs and boughs. As in the case of the woodpeckers, only two toes of each foot are directed forward, two being pointed to the rear.

The picture is that of a female and was obtained in the northeastern corner of the Belgian Congo. It is about two thirds natural size. The female lacks the throat patch of pure black by which the male is readily distinguished

# Profiteers of the Busy Bee

## OBSERVATIONS ON THE HONEY GUIDES OF AFRICA

By JAMES P. CHAPIN

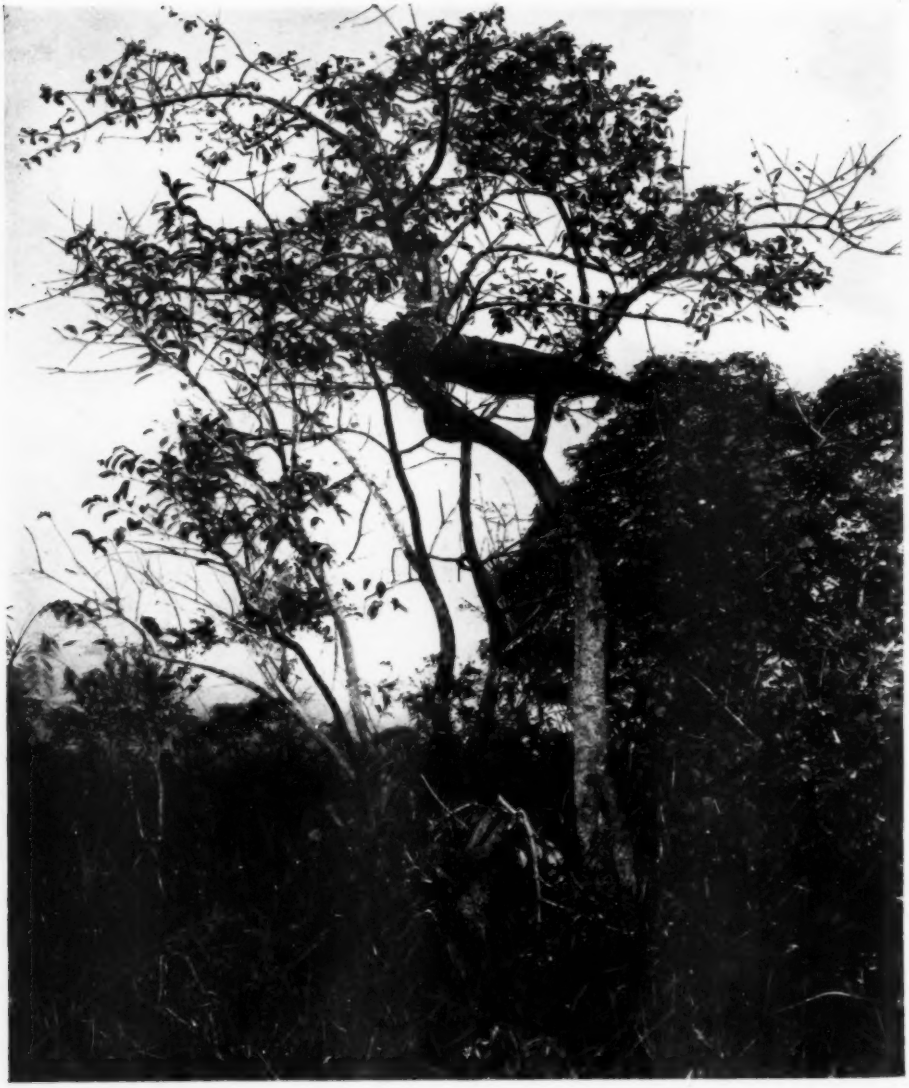
Associate Curator of Birds of the Eastern Hemisphere, American Museum

WERE a facetious journalist to attempt to endow a mythical bird with some startling but imaginary instinct, he would hardly be likely to go to the lengths to which nature has gone in the case of the common honey guide of Africa. The strange behavior of this bird has so long been known, moreover, that it surprises one to find how little has been written about it beyond simple accounts of the way the bird attracts the attention of men and reveals to them the location of beehives. Sparrman, who traveled in South Africa as long ago as 1775, gave one of the best descriptions from his personal observations, and was able to quote a still earlier account of the bird, accurate in the main, by Father Jerome Lobo, who had gone as a missionary to Abyssinia in 1625. As Sparrman concluded, the *moroc*, or honey bird, of the Abyssinians could be none other than the common honey guide. This testimony has been confirmed by a great number of travelers, sportsmen, and trained ornithologists who have since visited the open grassy regions of Africa, over which the bird is so widely distributed.

Avoiding the heavy forests of the Congo basin and other parts of western Africa, the common honey guide (*Indicator indicator*) ranges from Cape Colony to northeast Africa, and then across the Sudan to Senegal. It is a plain-colored, brownish-gray bird, scarcely larger than our American bluebird, but much more stockily built, with short dense plumage, and a skin so tough that it has often been considered a cuirass against the stings of bees. When fully grown, both sexes have half-concealed epaulets of yellow; and the male bird is then distinguished by a large black throat patch. The immature birds are somewhat greener and until a few years ago were regarded as a distinct species. The nearest relatives of the honey guides, in our North American fauna, are the woodpeckers; yet the honey guides have neither stiffened tail feathers nor an extensile tongue.

How well the honey guide is known and esteemed by the natives of the countries where it dwells may easily be imagined. By the Azande tribe of the northeastern Congo the bird is called *turubwa*, and I was told that before the arrival of Europeans an Azande chief would have cut off the ear of any man so stupid as to have killed a honey guide. Mr. Herbert Lang and I had many experiences with honey guides attracted by our caravans or hunting parties. It is the habit of the bird to locate one or more bee colonies and then wait for the passing of men, whose attention it attracts by a persistent chattering. At such times it is relatively tame and will alight in small trees only a few yards off. If a man wishes to learn where the hive is, he follows the bird, whistling occasionally to it.

Here I may quote an instance from my own notes. One afternoon in November, 1911, in a small wooded swamp near Faradje, a post in the



A beehive placed in a tree by members of the Logo tribe.—Perhaps the general scarcity of large hollow trees in the region renders an artificial hive attractive to the bees. It is so constructed that it can be pulled apart at the middle and put together again without entirely discouraging the occupants. The latter enter through a hole in the earthen partition at the larger end, to the left

northeastern corner of the Congo, we came upon a male bird, who at once started his chatter, and then flew off to some distance, returning shortly as though to assure himself that we were in earnest. We replied with low whistles, and following him through the tall grass and scrub, were led out on to higher ground. Now our feathered guide would fly noisily ahead about fifty yards until out of sight, perching on top of a bush and repeating the performance as soon as we came up. Presently another male bird joined him.

We had gone about six hundred yards when both birds stopped in a tree too small to harbor bees in its trunk. Yet by their short aimless flights and repeated returns to the tree, the honey guides impressed upon us that this was the spot. The buzzing of passing bees now was heard and the insects were traced to a small hole in the ground close by. During these proceedings the birds allowed us to approach within ten or fifteen feet of them.

We prepared to make a fire, and our birds retired noiselessly for the time. A little later I saw them again, sitting with puffed-out breasts and open bills, uttering a low *chwee-r-r*, which I had not heard before. They seemed to be quarreling, and one soon chased his rival off at top speed.

With the aid of some burning grass two of my black helpers quickly had the hive unearthed, paying a penalty of only six stings. The comb contained no honey, only pollen and bee larvæ. It was in a cavity previously occupied by termites. We placed some of the comb in the forks of a tree and went off to escape an impending shower. An hour or two later we found that the two birds had returned to peck at the comb; and the following morning I watched them come silently, the one after the other, to seize a piece of the comb and fly off with it. Without crediting the birds with actual foresight or intelligence, I do not hesitate to say that it is for this reward that they have worked.

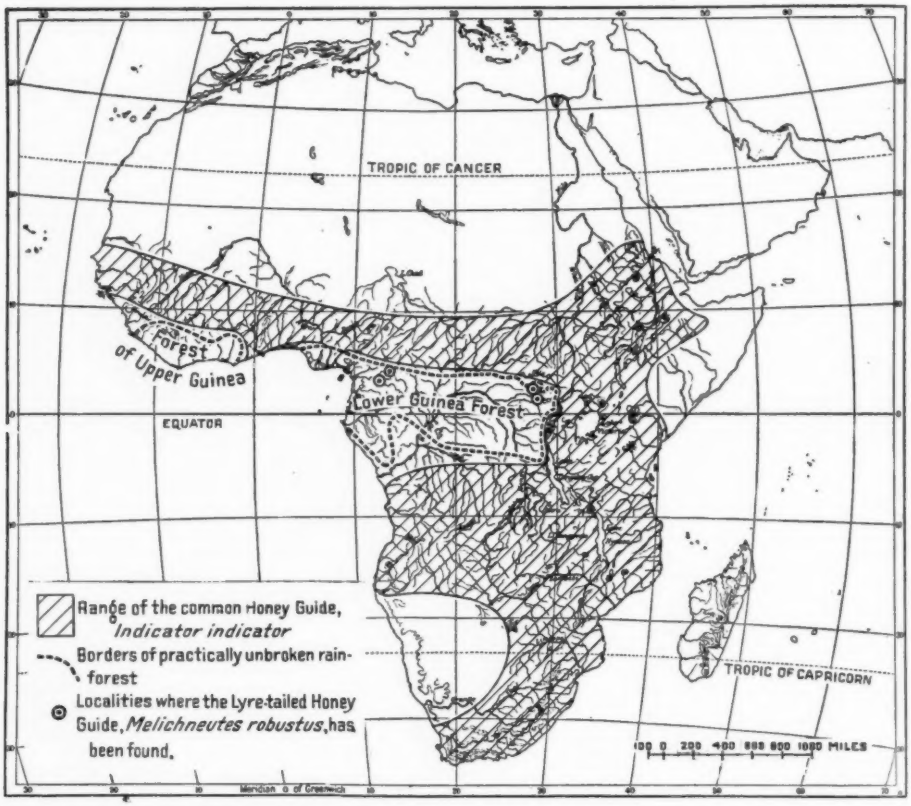
It is said that in sections where the negroes have artificial hives hanging in trees for the use of bees the honey guide makes no distinction and will lead to occupied hives established through man's agency as readily as to natural cavities housing wild bee colonies. This I believe, though I have not had occasion to verify it even among the Logo of the eastern Uelle District, who attract bees with hives made of reeds.

The assertion has also been made that the honey guide will sometimes lead a man up to a snake or a leopard, but this has been vigorously denied by experienced naturalists. A story far better founded is that of the honey badger (*Mellivora capensis*) following the honey guide. Major Stevenson-Hamilton[1] describes it as though he had often observed it himself. "You may be resting in the bush in the cool of the afternoon, or on some cloudy day, when your attention is arrested by the persistent and approaching chatter of one of these feathered spies. Presently the bird itself comes fluttering on to a branch some thirty yards distant, where it perches, flapping its wings, and displaying every sign of impatience. For a moment it is silent, and then a less familiar sound strikes the ear: a light sibilant hissing and chuckling, which at first you find yourself unable to identify... The honey-guide understands, and having, with undulating flight, sought another tree some thirty yards further on, renews his invitation. Keeping quite still, and looking steadily, you presently spy a little gray and black form, moving along at a steady jog-trot; the tail is carried slightly above the level of the back, and the head, except when raised to glance up at the guide, is held a little low. Every time the bird utters his monotonous refrain, which, translated into feathered language, means 'Come along, come along, don't be so slow,' the follower replies, 'All right, my friend, don't be alarmed, I am coming.' And thus the strange procession passes on out of sight to the hollow

[1] *Animal Life in Africa*, 1912, pp. 247–48.

log where the unlucky insects are industriously slaving, only ultimately to satisfy the appetites of bird and beast." The favorite food of this badger is honeycomb, and it has powerful claws with which to tear open the hive.

master lies in distress, although the motive is, of course, entirely different. It brings to mind also the story so widely circulated by the newspapers a year or two ago, of a gander on a farm in Alabama which used to lead a


TROPIC OF CANCER
Forest of Upper Guinea
Lower Guinea Forest
EQUATOR
TROPIC OF CAPRICORN
Range of the common Honey Guide, *Indicator indicator*
Borders of practically unbroken rain-forest
Localities where the Lyre-tailed Honey Guide, *Melichneutes robustus*, has been found.
MILES

Map showing the distribution of two African honey guides, one (*Indicator indicator*) an inhabitant of the open grass country, or savanna, the other (*Melichneutes robustus*) restricted to the equatorial forest

The instinct of the honey guide is unique among birds. It is far more complex than the "guarding" of buffaloes and rhinos by the oxpeckers (*Buphaga*). There the birds have come to feed on the ticks that cling to the animal's hide, and they merely alarm their hosts by their cries when they take flight at the approach of an enemy. The honey guide, on the other hand, recalls the action of a dog in leading a stranger to a spot where its

blind ox to the watering trough every day by its cackling. I cannot vouch for the truth of this narrative, though photographs of the strangely assorted couple appeared in a New York paper of good repute.

No doubt the specialists in animal behavior have an explanation that does not require any reasoning on the part of the honey guide. The guiding is instinctive, for it has become hereditary with at least one species of

*Indicator*, and is practised by old birds of both sexes, and apparently by immature birds as well. The fact that it is a characteristic form of behavior throughout the whole range of the species argues for its remote origin and leads us to believe that the instinct grew up slowly with the evolution of the family, though man is not always the beneficiary. The honey guides must have preyed on bees long before savage man reached Africa, and we may speculate, quite properly, as to the origin of the guiding instinct.

The honey guide family (Indicatoridæ) is not a large one; it comprises, nevertheless, five genera[1] and about twelve species, of which two are found in the Oriental region, the remainder in Africa south of the Sahara. None of them exceeds seven and a half inches in length. I myself have secured specimens of six species for the American Museum and may thus claim a speaking acquaintance with four of the genera. Yet none save *Indicator indicator* ever offered to guide me to a beehive. A patient search of books and articles dealing with African birds reveals only one other species, *Indicator variegatus* of East and South Africa, which according to reliable authority,[2] renders the same service to mankind. Sir John Kirk[3] seems to have used the name *Indicator minor* in his oft-quoted account through mere accident, this being the only species in the collection upon which he was reporting. His description of the habits is quite clearly based upon *I. indicator*.

It is entirely safe to say that the majority of honey guides do not guide, or at least do not guide men. Nevertheless, I have noted in examining their stomachs in the Congo, as has Mr. G. L. Bates in the Cameroon, that more often than not these other species have swallowed beeswax, just as does the common honey guide, which has hives opened for it by men. Other insects, such as winged termites and perhaps adult bees in the open, are also preyed upon occasionally, but bee comb and bee larvæ seem to be preferred. The stomach contents not infrequently smell of honey, and we may suppose that the wax is swallowed incidentally—not by preference.

The one evident exception to these tastes is seen in the genus *Prodotiscus*, which differs in many respects—the bill and plumage especially—from all the other genera of the family. It does not eat bee larvæ, and one of the species frequents, it is said, trees of the genus *Sterculia* when they are in flower.

How then do the normal honey guides procure their favorite food? The only bees in Africa from which the wax could come are the common honeybee, *Apis mellifera* (represented by a somewhat smaller African race), and the much smaller species of *Trigona*, which are stingless. The honeybees, we know, nearly always store their sweets in a secure place,—a cavity in a tree, among rocks, or in the ground, where the birds unaided have little chance of stealing them. The nests of *Trigona* are usually in hollow trees, and are if anything harder to get at. Had the honey guides the strong chisel-shaped beak of their allies, the woodpeckers, they might hew their way through the wood; but, as it is, they are without any tools for use in such a direct attack. Birds of the genus *Melignothes*, for example, have an exceptionally blunt beak.

Thus all the typical honey guides eat honeycomb and yet are apparently un-

[1] *Melignothes*, *Melignomon*, *Indicator*, *Melichneutes*, and *Prodotiscus*.
[2] Ivy, *Ibis*, 1901, p. 21.
[3] *Ibis*, 1864, pp. 327–28.

able to secure it without help. What else can we conclude save that they adopt some method similar to that reported from South Africa, of enlisting the aid of the honey badger? In the forests of western equatorial Africa this mammal is extremely rare or

The head of the lesser honey guide, *Melignothes minor*, natural size.—Note the extremely blunt beak, serviceable perhaps for tearing honeycomb apart, but of little use in pecking open the tree where it is hidden. Drawn from a specimen by W. E. Belanske

wanting, and therefore we may only guess that squirrels, small carnivores, lemurs, or monkeys, are the creatures with which the honey guides carry on this commensal existence. This seems a bold assumption, but it is the best explanation I can offer of what we know to be their food habits. An alternative would be to suppose that the honey guides simply happen upon the hives after they have been robbed by some other animal. I doubt if they would get as much plunder in this manner as we know they secure.

It seems credible that the partnership began in such a way, but that sooner or later the birds took to accompanying bee-hunting mammals until finally the bird became the leader. The theoretic bearing of observations on the honey badger and its bird guide is now evident. Once the method had been well worked out with certain lower mammals, man would have been admitted into the association as a matter of course.

The breeding habits of the Indicatoridæ are bizarre, and similar to those of the parasitic cuckoos of the Old World or of our North American cowbird. Each white egg is deposited in the nest of some other bird, preferably that of a barbet, which is hewn out like a woodpecker's hole. Where possible, the adult honey guide breaks the legitimate eggs, it is said, and when the young is found, it is always the sole occupant of the nest. In the two species which lead men to hives, *Indicator indicator* and *Indicator variegatus*, Dr. Alwin Haagner[1] has found that the nestling has both upper and lower mandibles armed with a sharp, curved hook, as though for seizing any competitors and ejecting them from the nest it has usurped. It is said that these hooks are shed at about the time of leaving the nest. In two other members of the family, *Melignothes conirostris* and *Melichneutes robustus*, I have examined skins of nestlings partly fledged, but found only the usual egg-tooth on the upper mandible.

Among the honey guides of the West African forests, from the Cameroon to the upper Congo, there is one with a most unusual development of the tail, *Melichneutes robustus*. The four middle tail feathers are curved outward at the tip, and the three outermost on each side are greatly narrowed and shortened, reminding one of the outer rectrices of some snipe. This lyrate tail of *Melichneutes* has been compared to that of the black cock of Europe, but it is the small snipelike feathers that prove most interesting.

In this forest region of the upper Congo one may hear throughout a large portion of the year a reiterated note of tin-horn quality, the double syllables rising slowly in pitch, then dropping off, and repeated from twelve

[1] *Journ. S. Afr. Orn. Union*, Vol. III, 1907, p. 3, pl. 1.

to thirty times. It may be heard afar, certainly at a quarter of a mile, and seems to come from above the forest canopy. The natives I consulted were all ignorant of the common honey guides of the grasslands and could not tell me what kind of bird we were listening to. Some ventured the opinion that it might be a woodpecker; but all were familiar with the sound and had a name for its author, the Azande of the southern border of the Uelle District calling it *nyĕté* in imitation of its voice. From 1910 to 1914 I wondered what the bird could be; and then, on the occasion when I secured my only specimen of *Melichneutes*, I heard the strange noise given after a second bird of the species had flown off from the same high tree in the forest. It is almost certain that the *nyĕté* is none other than our lyre-tailed honey guide. The "bleating" of certain species of snipe, it has been shown, is produced by their narrowed outer tail feathers during flight, by vibration of the webs as the air passes between them.[1] Is it not likely, too, that the nasal, tooting call of *Melich-*

[1]Bahr, *Proc. Zool. Soc. London*, 1907, pp. 12–35.

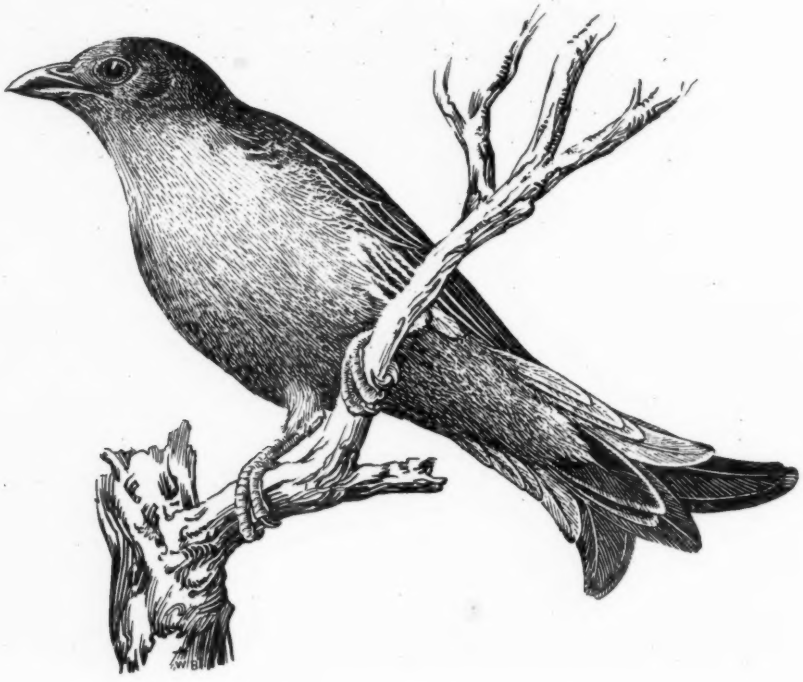
A young honey guide of the genus *Indicator*, only a few days old.—This drawing, about natural size, was made by W. E. Belanske from a photograph by Dr. Alwin Haagner, director of the Pretoria Zoological Garden. The young bird, the feathers of which are beginning to sprout, was found in the nest hole of a diamond sparrow, *Petronia superciliaris;* and from the fact that an adult of the scaly-throated honey guide (*Indicator variegatus*) had previously been seen in the tree, it was inferred that the young bird was also of that species.

The extraordinary hooks at the tips of both mandibles may be homologous with the extensive calcareous cap which at first covers the entire tip of the upper mandible of young woodpeckers, although the latter have nothing of the sort on the end of the lower mandible.

Doctor Haagner later received a live nestling of the common honey guide (*Indicator indicator*) almost fully fledged, which still retained both hooks on its beak. After a few days that on the tip of the lower mandible was shed, and the upper one would doubtless soon have followed suit, had the bird survived.

The foot was not shown in the photograph, but has been introduced in the drawing from a somewhat older nestling of *Indicator* in the American Museum collection. Note the roughened heel-pad, which recalls those of young barbets and toucans—neither of them very distant relatives

*neutes* is made by the air rushing past the edges of the same feathers? We know that *Melichneutes*, while perching, emits a hoarse chattering vocal note, which is entirely different. For future field naturalists in equatorial Africa I would suggest a thorough investigation, though it will be anything but easy. For I suspect that when the life history of this most remarkable of honey guides is more fully known, it will be found that it summons by its curious note some mammalian accomplice to aid it in robbing the hoard of an industrious colony of bees.



Adult male of the lyre-tailed honey guide, *Melichneutes robustus*, about seven-tenths natural size; drawn by W. E. Belanske from the single individual secured by the American Museum Congo Expedition.—Only three adult specimens and two young are preserved thus far in museums. There is very little difference between the sexes, even in respect to the curious modifications of the tail feathers; and the tail of the young foreshadows clearly that of the adult, though the young in first plumage differs in having the head and breast blackish instead of olive and gray.

The feathers here seen extending out beneath the middle of the tail are merely coverts, the true middle tail feathers are somewhat lyrate. If, as the writer suggests, the tail serves as an æolian sound-producer, the "strings" are placed outside instead of between the arms of the lyre, in the form of narrow, relatively stiff feathers on each side.

This specimen was shot by the writer from its perch in the top of a tall tree in the Ituri forest, after he had scrutinized the extraordinary tail through a binocular

# Amateur Entomologists and the Museum[1]

## A SURVEY, FROM THE HALF-CENTURY MARK, OF THE DEPARTMENT OF ENTOMOLOGY, AMERICAN MUSEUM

By FRANK E. LUTZ
Curator of Entomology, American Museum

ONE of the very pleasant features of the work on insects in the American Museum during recent years has been the cordial cooperation of amateur entomologists. I have recognized and warmly appreciated this aid but not until I had reviewed the steps by which the Museum's collections of insects advanced in fifty years from nothing to a place near the front rank did I realize how important such aid from amateurs had really been.

Baron Osten Sacken was Russian consul general in New York City from 1862 to 1871. Doubtless he did his diplomatic work well but his fame rests upon his recreation, the study of insects. His particular interest was Diptera, the group to which flies and mosquitoes belong, and of these he described nearly four hundred new species from North America alone. He was evidently much interested in the newly established American Museum of Natural History, for in 1870 he presented to it specimens representing about a thousand species of insects.

At about the same time Mr. Coleman T. Robinson presented his collection of about 3000 species and served as curator without salary until his death two years later. Mr. Robinson's hobby was butterflies and moths and he collaborated with Mr. August R. Grote, one of the foremost authorities on Lepidoptera at that time. These two collections, supplemented in 1874 by a collection of about 2000 species presented by Mr. R. A. Whitthaus with the wish that it should be set aside exclusively for the use of persons especially interested in entomology—in other words, that it should be a study collection—were the start of our work in this field.

Apparently, however, these splendid foundations were not built upon speedily. Little seems to have been done until in 1884 Mr. Joseph W. Drexel, a Trustee of the Museum, presented some butterflies and moths, which, together with the previous gifts (except for types and rare species) were exhibited in newly constructed cases and, according to the *Annual Report* for that year, formed one of the most attractive features of the "main hall."

No one in particular seems to have been in charge of insects after Mr. Robinson's death until the appointment of Mr. E. B. Southwick in 1886. The following year the collections were placed in charge of Mr. L. P. Gratacap, then assistant curator of the department of geology, and in 1888 Mr. William Beutenmüller was engaged to give his whole time to entomological work in the Museum. Naturally, much of the valuable material received in the seventies had been destroyed by "moths" and other misfortunes during the time when no one was in special

[1]The author is indebted to Mr. A. J. Mutchler, assistant curator in charge of Coleoptera and the oldest member, in point of Museum service, in the department of entomology, for bringing together the facts connected with the history of entomology in the Museum.

INSECTS AS ALLIES AND AS ENEMIES OF MAN

Insects are frequently set down in the mass as man's enemies and, indeed, certain injurious species are among the most irrepressible of his foes, devastating his crops as aggressively as an invading army. But the damage wrought by such insects is more than outweighed by the good done by others. A vast number of plants upon which we depend for food, or which bring cheer into our lives through the beauty of their blossoms, would disappear from the earth if they were not visited by insect pollinators.

In the upper picture is shown the codling moth, *Carpocapsa pomonella*, which annually takes a heavy toll of our apple crop; but there would have been no crop at all if other insects had not coöperated.

Below is an old-fashioned straw beehive, suggesting the activities of one of the most useful of insects, *Apis mellifera*, which was domesticated by man centuries ago and has been introduced by him into America, where it is today so well established that the uninitiated are apt to look upon it as one of our native insects

charge, and many of the specimens that had survived were in poor condition, but a sufficient number of them are still in existence to show what a splendid start had been made.

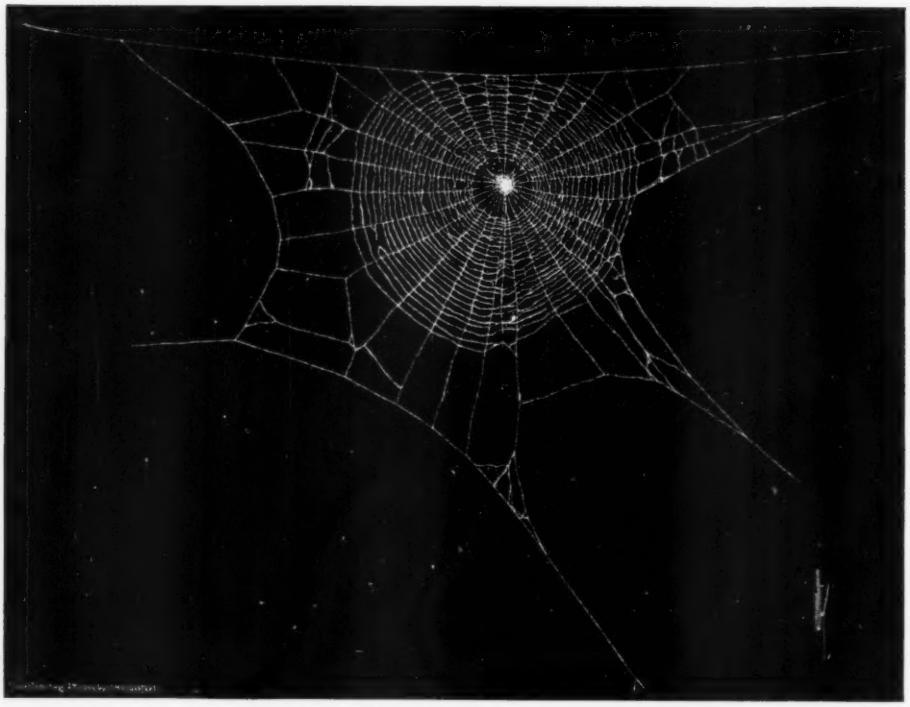
With the appointment of a regular curator and thanks to the keen interest of Mr. Morris K. Jesup, then president of the Museum, entomological activities were briskly revived. Exhibition work along new lines was begun, the life history and other phases of insect biology being shown and made more valuable by the use of artificial leaves as accessories. Reflecting one of Mr. Jesup's particular interests, these new exhibits were largely concerned with insects injurious to trees.

The next few years brought several notable accessions, all the work of amateurs. Mrs. M. Schuyler Elliot presented the butterfly and moth collection that had been made by her son, Dr. S. Lowell Elliot. It is chiefly remarkable for the large number of reared specimens, many of the rarer forms being represented by entire broods showing the variation within a species. The collection of Mr. James Angus, a resident of West Farms, New York City, contained a large number of local species and was also a gift. But the most notable accession was that in 1892 of the widely known "Harry Edwards Collection," containing about 250,000 specimens from all parts of the globe.

Mr. Edwards was an actor and had been connected with various companies in the United States, Central and South America, and Australia. He went to Australia as a manager for A. M. Palmer's *Little Lord Fauntleroy* organization, returning in 1890 to join Austin Daly's company. During his travels he personally collected many specimens and purchased others. For three years he was the editor of *Papilio*, a journal devoted exclusively to butterflies and moths, and he was also the author of a large number of valuable papers on these beautiful creatures, his last contribution to entomology being a *Bibliographical Catalogue of the Described Transformations of North American Lepidoptera*. His last appearance on the stage was in New York as Sir Oliver Surface in *The School for Scandal*. After his death his collection was purchased, nearly $10,000 having been given by friends of Mr. Edwards in response to appeals from Mr. Palmer and other members of the stage. Though once noted in his profession, he will be remembered, like Baron Osten Sacken, as long as science exists for the things which he did as recreation.

In 1897 The Very Reverend E. A. Hoffman became interested in the Museum's entomological work, generously contributing to its support until his death in 1902, and his son, Mr. Samuel V. Hoffman, continued this support for several years thereafter. The results of this financial aid were a large collection of butterflies, each in a plaster mount, and a number of field trips by Mr. Beutenmüller to the Black Mountains, North Carolina. The butterflies were put on exhibition, but recently we felt that most of them were more valuable as scientific specimens than as exhibition material and, as they were fading because of their exposure to light, we have placed them in light-proof cases in the study collection. They are safe there and may be seen by anyone sufficiently interested to ask permission.

In 1903, Prof. William M. Wheeler became curator of invertebrate zoölogy, a department separate from entomology, but Professor Wheeler was then, as now, one of the leading entomologists



Although spiders are not insects, they rival them in interest, and in the popular mind are grouped with them. The webs spun by spiders are usually of so fine a texture that we are unable to trace them in detail unless they are sprinkled over with dew or powdered with dust, and even then only inadequately. Webs mounted on a dark background, with their strands thickened so that they are distinctly visible—a process devised by Mr. C. H. L. Gebfert—are among the striking exhibits of the department, as the accompanying picture of the web of *Eustala anastera* gives evidence

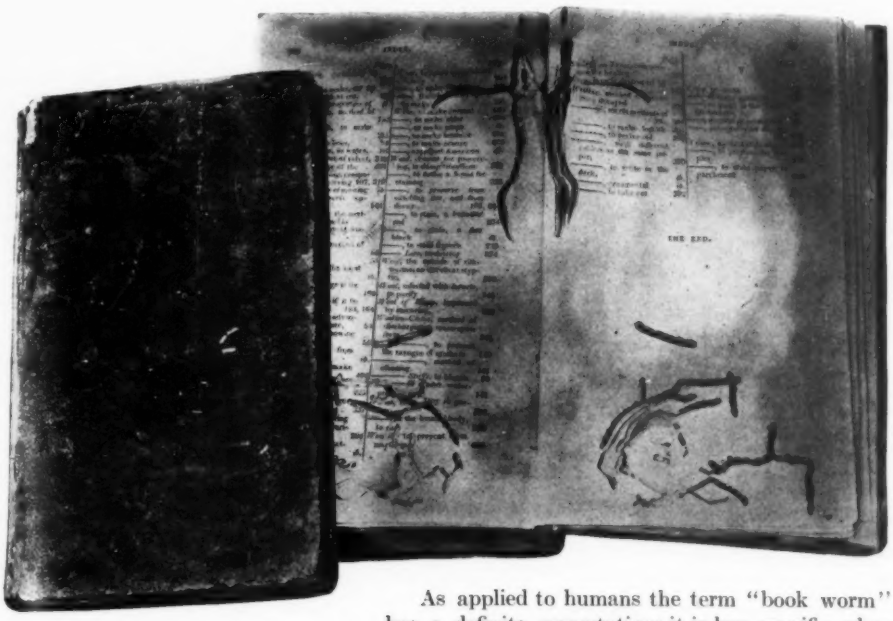
of the world. Although not officially connected with the department of entomology, he continued his most valuable studies on ants and presented to the department his collection of more than a thousand species of Diptera, including about two hundred type specimens of species which had been described by Wheeler, Melander, and Brues. On his resignation in 1908 to become professor of economic entomology at Harvard he presented to the Museum his wonderful collection of ants but took it with him as a loan in order that he might continue his studies. Fortunately, as research associate of social insects, he still retains his interest in and connection with the Museum.

Prof. Henry E. Crampton succeeded Professor Wheeler as curator of invertebrate zoölogy and the hitherto independent department of entomology was put in his charge with Mr. Beutenmüller as associate curator of Lepidoptera. The writer was appointed assistant curator of invertebrate zoölogy and given charge of insects other than Lepidoptera. Mr. A. J. Mutchler remained, as he had been for six years, Mr. Beutenmüller's assistant, and Mr. Charles Wunder was engaged to help with the other insects.

In the twenty years that had elapsed

Aphids—those pests of the gardener—are beloved of the ants, which protect them as sedulously as man destroys them. The aphid gives forth a sweet secretion—the "honey dew" of the ancients—and it is because of this that they are favored by a group of insects notable for having a "sweet tooth." Some species of ants even stroke the aphids with their antennæ to induce them to void the honey dew, a procedure suggestive of milking. Hence Linnæus appropriately referred to aphids as ants' cows. A forward step in the domestication of the aphid is shown in this photograph, taken by the author at Ramsey, New Jersey. It represents a "cow shed," or protective structure built about the aphids. So that the "cattle" might be revealed, the roof was partly demolished before the photograph was taken. Field work forms an important part of the activities of the department of entomology and, as this photograph indicates, one does not have to stroll far from home in order to see matters of interest

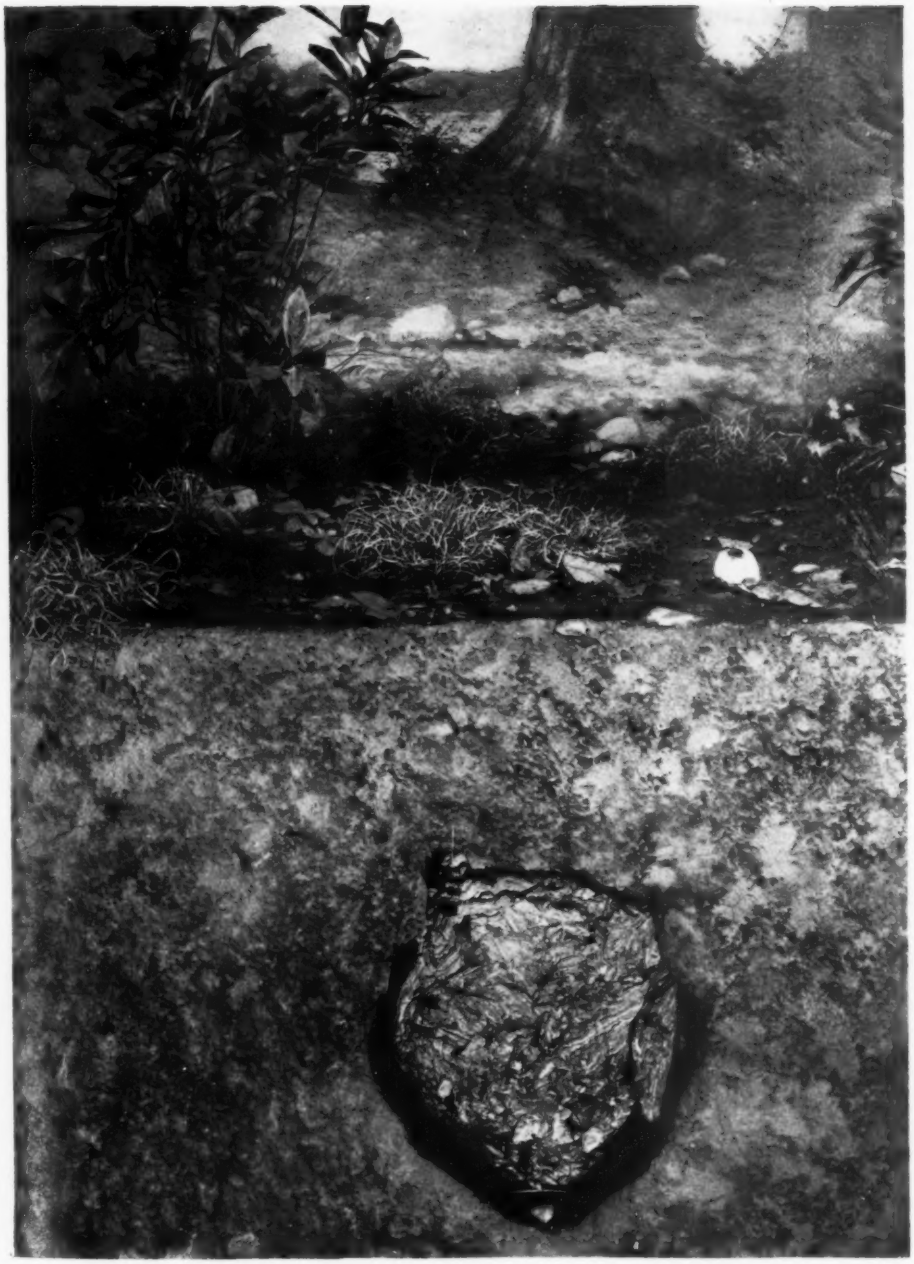
*Photograph by the author*




As applied to humans the term "book worm" has a definite connotation; it is less specific when used in describing insects. Certain members of a family of beetles (*Ptinidæ*) are among the principal destroyers of literature. One member of this family has a record of having "penetrated directly through twenty-seven large quarto volumes in so straight a line that a string could be passed through the opening and the whole series of volumes suspended." In the tropics termites rival the Chinese emperor of old who made a holocaust of the then-existing literature, in ruthlessly attacking books as well as many other things. The retardation of knowledge in some countries has been ascribed in part to the lack of respect of these insects for the printed word

THE POLISTES EXHIBIT IN THE AMERICAN MUSEUM

The genus *Polistes*, like *Vespa*, is made up of social wasps but, in contrast to *Vespa*, the nests of which are enveloped with a wrapping of "paper," *Polistes* builds nests consisting of an exposed comb. The nest is started by an over-wintered queen, who may select as her building site the under side of a porch roof, the eaves of a house, or any other protected place. In the exhibit pictured above, an old shoe was chosen; but the *Polistes* mother, unlike the old woman who chose a similar domicile, finds a use for the numerous daughters that constitute her family, to whom is entrusted the care of the larvæ and the enlargement of the nest. In the can is shown a nest that was started but subsequently abandoned



A NEST OF VESPA EXHIBITED IN THE AMERICAN MUSEUM

Although nests built in the open by social wasps of the genus *Vespa*, which includes the hornets and the yellow jackets, are frequently noticed, those built under ground are revealed only to him who has the enterprise to excavate them,—a somewhat hazardous undertaking if attempted before the wasp colony dies out in the fall. The "paper" that surrounds these protected nests is not nearly so tough as that made by species which build above ground. Moreover, in Europe and North America it is the short-cheeked species of *Vespa* that for the most part build in burrows in the ground, the long-cheeked forms constructing as a rule aërial nests. This exhibit shows a nest of yellow jackets that was started by the mother wasp in a mouse burrow, the cavity being enlarged as the needs of the colony grew

A more uncomfortable position in which to take one's rest than that here illustrated would be hard to imagine. While this *Sphex* wasp dozes, its jaws do not relax their hold on the support. Its attitude suggests an acrobatic performance, but it is the way the insect takes its ease. The exhibit was arranged by Mr. Henry Bird

since the first appointment of a regular curator of entomology the collections had grown immensely. I have mentioned only a few of the larger steps in this growth, for to do more is impossible at this time. Not at all as a criticism but as a statement of fact, it may be said that the collection of insects had been enlarged out of all proportion to the staff (a curator and one assistant) that had it in charge. Mr. Wunder and I were confronted with a total of more than 300,000 specimens most of which required labeling and few of which were classified even as to order. These were exclusive of Lepidoptera and the "arranged" collection of other insects. That this condition of affairs does not now exist and that, although our collection of insects has had since then an average growth of about 50,000 specimens a year, practically every specimen is labeled and ready for study is due to the conscientious work of Mr. Wunder and the coöperation of the entomological assistants, Mr. Mutchler (appointed assistant curator in 1922), Mr. John A. Grossbeck (deceased), and Mr. F. E. Watson, aided, as other work permitted, by the entomological typist. The splendid and welcome accessions to the collections since 1908 are matters of such recent record that they will not be repeated here.

In 1921 entomology was again made a separate department, the staff consisting of a curator, two scientific assistants (Mr. Mutchler and Mr. Watson), a general assistant (Mr. Wunder), a typist and three research associates (Prof. Wheeler in social insects, Mr. Charles W. Leng in Coleoptera, and Mr. Herbert F. Schwarz in Hymenoptera) who serve without pay. In addition, I am most happy to say, the department is aided by a number of amateur entomologists, members of

the New York Entomological Society and others, who liberally give us time and specimens—money many of them do not have to give—receiving no other reward than the pleasure of helping the institution help others to learn about the creatures which are of so much interest to them.

Some indication of the amount of scientific work accomplished may be had from the amount of publication. It is of interest to note that in the last fifteen years the Museum's entomological activities have contributed approximately 5500 pages to the *Bulletin*—about one-third of the total number of pages of that publication. Other papers have appeared elsewhere. This relatively large contribution could not have been made solely by the Museum's small entomological staff and, as a matter of fact, more than half of the articles, although based upon Museum material, were written by outside workers, either amateur entomologists or members of the staff of some sister institution.

We feel that the Museum owes a great debt to amateur entomologists and to the public from which the amateurs of the future are to be recruited. One of our rooms has been fitted out as a meeting place for the New York Entomological Society and a collection of insects found within fifty miles of New York City has been placed in charge of that society. This collection is freely open to amateurs for study. In the exhibition hall we are trying to present insects not as often beautiful and sometimes curious creatures, but as having most interesting habits,—a fascinating group the study of which many lifetimes will not exhaust, a group, moreover, that is represented on every hand as is shown by the exhibit (now being arranged) of hundreds of different kinds found in a town lot only 75×200 feet in extent.

Recently an enclosed space within the exhibition hall has been set aside

The auditory organs of insects are located in unexpected places. Grasshoppers have on the first segment of their abdomen a membrane that serves as an ear. The male mosquito *Culex*, on the other hand, uses its antennæ to detect sound. The antennal hairs vibrate sympathetically to certain tones, and their response is greatest to the note represented by the female's hum. No stranger location for a hearing organ suggests itself, however, than the leg. Yet a number of insects, including crickets, long-horned grasshoppers, ants, termites, and stone flies have their auditory organs situated on the forelegs. The model of a cricket's foreleg, prepared by Mr. Ignaz Matausch, illustrates clearly the light-colored membrane that probably functions much as does our ear drum

Adjoining the insect exhibits on the third floor of the American Museum, is an enclosed space that has been reserved for the exclusive use of Boy Scouts. Here they may keep their working materials and their specimens, which include not only dead insects to be mounted but live insects in the larval, pupal, and adult stages, also formicaries, and even animals other than insects that are being studied by the Scouts. Here Mr. B. T. B. Hyde, educational director, Kanohwahke Scout camps, Palisades Interstate Park, has established his winter headquarters, and the picture shows him and a number of his Scouts engaged in their indoor activities

for the use of Boy Scouts interested in entomology. Here they may mount insects they have collected and watch the development of live specimens they have captured in the larval stage; here too they may get that wider acquaintance with the insect world which is offered by the exhibition collections.

Our scientific work, including the field trips, is not being directed primarily toward studies of any particular orders of insects but centers about the problems concerning evolution, particularly those of geographic distribution and the interrelations of insects and their environment. These studies have taken us to Labrador, Florida, the West Indies, and South America, and, in recent years, to the Rockies and other parts of the West. A number of friends, especially Mr. B. Preston Clark, have kindly given financial aid to these trips and now, through the generosity of other friends, the department has an automobile fitted up as a camping-collecting car for use in field work.

Naturally, we hope that our department may continue to enlarge its collections and, what is even more needed, its curatorial staff; but our most earnest hope is that we may be increasingly helpful to the amateur entomologist. It is from this class of naturalists that we derive much of our support, and honesty demands efforts to repay our debt.

The colony of beavers at Lava Creek, Yellowstone National Park, have erected a dome-shaped house of impressive size. The dam seen in the foreground is enlarged a little each year by the beavers, and as a result the government engineers are compelled each year to raise the road that runs along the shore of the creek

# A Beaver Colony of Yellowstone Park[1]

By M. P. SKINNER
Park Naturalist, Yellowstone National Park

Inhabiting two centuries ago the greater part of the North American Continent, ranging southward as far as the Rio Grande and extending northward into the Arctic Circle, the beaver was subsequently threatened with extinction due to the merciless demand for its fur. Today, thanks to the respite from persecution that it has enjoyed, it again occupies half of its original territory. It is a pleasure to note that it has built in the security of some of our national parks. Visitors to the Rocky Mountain National Park, for instance, are familiar with the structures erected by beavers within that sanctuary. The wild life of Yellowstone National Park rivals in appeal the geysers of the region, and the establishment some years ago of a beaver colony near a roadway, where it might be viewed by the thousands of people who annually visit the park, was a development of interest. That colony has now grown to proportions that justify a review of its history.—EDITOR.

WHEN I first knew the locality herein referred to—a willow meadow, hard and firm most of the time but swampy in spring—no beaver were to be seen in it. About 1910, I noticed beaver signs near the bridge below the meadow, and I assumed the beaver concerned had come up from the river three miles away. I doubt if there was more than one animal at first and he contented himself with a burrow in the bank of Lava Creek. A few years later he was joined by a second beaver, and in the spring of 1914 the trees cut down for food and the twigs stripped of bark became more conspicuous. Soon after that the beavers began moving up a small stream flowing in from the east through the swampy meadow. Late that summer small dams were built and a series of little ponds was de-

[1]Photographs by the author.

veloped, but still there was no house visible.

During the following September the beavers started work on the main dam and although they did not build it high at first, the barrier was sufficient to cause the water to back up. Whole branches were used, the branchlets and twigs sticking out and interlocking with those of adjoining branches and thus offering resistance to the stream. The larger branches and trunks of aspen were placed in the lower part of the dam with some willows on top. (In other places, where aspens are scarce, beavers have shown themselves adaptable and have built with willows only, or even with mud if the better materials could not be had. When obtainable, stones have been used to weigh down the branches.) Each autumn during the following four years the dam was built a little higher, and additions were made to the house, which had evidently been started at the same time as the dam although it was so small at first that it failed to attract attention.

By 1919 the colony had increased to twelve beavers, and, needing bigger accommodations, the animals all set to work tearing down the old house and erecting in its stead one of the largest houses I have ever seen. The site was the highest part of the pond bottom and the new house was a domed structure of mud with interlaced aspen branches of fair size, so placed that it would be exceedingly difficult for a coyote or a wolverine to dig through. While the building was going on, the entrance burrow was dug out and the interior chamber roughly shaped, the finishing touches being given later. This house is still the main home of the "original settlers," although several colonies have left it to go elsewhere.

After the house was finished an addition was built to the dam, and each year since, a little more has been added to keep the water at least three feet deep over the mud and silt that each spring freshet brings down. This complicates the work of the government engineers, who each year must raise the road along shore to keep above the rising water.

The locality had little beaver food except a few aspens, the willow bushes, and some water plants, and with the increasing population these were soon in danger of giving out. So the beavers started new works to the south, forming two more ponds and gaining access to a fine grove of aspens. In 1921 they built another house in the middle pond, and in 1922 they started yet another. During these operations much pine and fir land was flooded and the trees killed, with the result that the scenery is somewhat marred by the dead trees.

In Yellowstone Park beavers are protected, but it takes time for them to find it out. At first beavers were glimpsed only on moonlight nights, but now they are becoming so tame they are easily seen in daytime by the thousands of tourists that frequent the park. When the intelligent animals found that people did not molest them, they came out earlier and earlier, and now they often appear as early as three o'clock in the afternoon. But they still make their repairs and additions to house and dam at night, so that it is not often that they are seen at work. At present they number about twenty.

Usually the first indication of beavers is the sudden appearance of a small round head shooting up to the surface near the house, followed by a long, flat, brownish back. A V-ripple silvers the surface as the beaver circles about the house, and sometimes around the pond, to see if all is safe. Then the animal makes a straight course to the upper end of the pond where the willows grow. When a willow is found to his liking, he rises up on his legs, braces himself with his strong tail, grasps the willow with his paws, and cuts it off with one or two bites of sharp teeth driven by powerful muscles. The branch is taken by the butt and the beaver, with head higher and back lower than usual, swims off to a favorite eating place with the branch trailing behind. Arrived there, he crouches half in and half out of the water, grasps the willow crosswise with his fore paws (I almost said "hands," so soft and free from hair are they and so expertly used) and turns it rapidly about as the

teeth strip off the bark. He works fast, and soon a peeled switch is left to mark the feast. Sometimes the branch is taken to the house, or dam, and the switch left there to strengthen the structure.

After a hearty meal, the beaver is apt to wash and smooth his fur. A peculiar split nail on the second toe of the hind foot is used, it is said, in combing the hair; I cannot vouch for this from personal observation, but I have seen our little friend dress his fur with his paws, afterwards washing them, his arms, and face cat-fashion. On the score of personal cleanliness, I am inclined to place the beaver very high indeed. Living as he does in close, crowded quarters all winter, he must be cleanly, or vermin would make his life miserable.

Willows did not always satisfy the beavers, and they craved aspens; but aspens grew farther away from the water and the animals had to go overland to secure them. They were rather awkward on land: in walking their toes were turned sharply out, and the high arched body swayed from side to side on the short legs, while the broad, heavy tail swung sidewise also but in the opposite direction. The task of the beavers was a hard one and when they started bringing the aspens back, they found it necessary to cut them into short sections, from one to four feet long, after trimming off the branches. Even so, many a time it took two or three workers to master a load. Then their engineers began building canals from the pond towards the "wood lot," for they found it easier to tow logs by water than to drag them over land. Also it was safer, for a beaver disturbed by wolf, bear, or bobcat could escape much faster by water.

Unlike the bear and some other animals, beavers do not hibernate and must eat all winter. Accordingly in the autumn, on the approach of cold weather, they busy themselves taking branches and tree sections to a pile near the house, where they are sunk to become available as food in winter when the pond is closed by ice. At Lava Creek, not so much food is stored, for there is a spring near the road and the comparatively warm water prevents the formation of ice over an area of a few feet. The patch of clear water permits the beaver to leave his winter prison if food becomes scant.

A beaver taking a willow branch to the storage pile near the house, to be used as food when the pond freezes over

# American Men of the Dragon Bones

## PERSONAL IMPRESSIONS OF A FIELD TRIP TO MONGOLIA WITH THE THIRD ASIATIC EXPEDITION

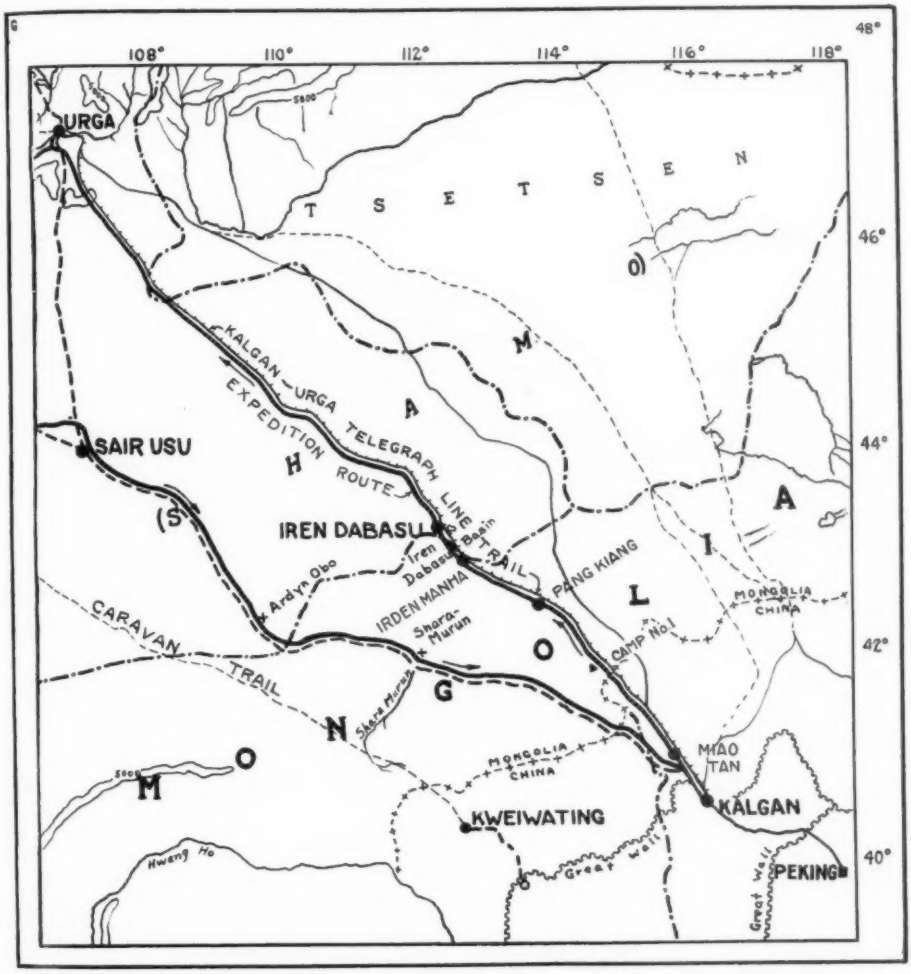
By HENRY FAIRFIELD OSBORN

FOREWORD.—Barely escaping the catastrophe in Yokohama, Professor Osborn arrived in Shanghai Tuesday, September 4, and received from Mr. Roy Chapman Andrews the following telegram: "Greatly worried about you. Am holding entire expedition in Mongolia awaiting your arrival." This anxiety was due to the failure of the American wireless station in Peking to get detailed news of the casualties of the Yokohama disaster. On receiving a reassuring reply, Mr. Andrews wired, "Thank God, you are safe! Awaiting you in Peking." In Peking at last, after two years' delay, Professor Osborn was greeted on the platform by Mr. and Mrs. Andrews. Mr. Andrews was full of suppressed excitement over the discovery of dinosaur eggs, a relatively small but ultimately momentous incident in an expedition so full of great discoveries. Messrs. Osborn and Andrews outfitted at once and started September 12 by train to Kalgan, close to the Mongolian frontier, at which point these notes from a week's diary crowded with interesting entries begin.

LEAVING Peking September 12 at half past eight, we arrived in Kalgan at three-thirty that afternoon and were met by John McKenzie Young, chief of the motor fleet of the Third Asiatic Expedition of the American Museum and *Asia* Magazine. Highly trained as an expert mechanician, with a fine record in the United States Marine Corps service, Young succeeded Colgate of the 1922 expedition and, ably assisted by C. Vance Johnson, another United States Marine Corps veteran, brought the fleet of five motor cars over six thousand miles of rough Chinese roads and Mongolian bowlders and sands triumphantly to the end of two years of service, and in such splendid condition that the entire fleet was sold to Chinese merchants at half the original cost.

From Kalgan, dusty and prosperous, Young guided our four-passenger Dodge car along the center of a dry river bed, where not a drop of rain had fallen for months, through cañons bordered by ancient towers, fortresses, and walls, over the first mountain ridges, and into broad open plain. We were deeply impressed with the Chinese struggle for existence, with the evidence of overpopulation, with the triumphs of Chinese agriculture—triumphs which have doubtless been accumulating for the last 12,000 years, since the first colonists settled on the Yellow River. Every bit of land is intensely cultivated; every mountain-side is terraced to the very summit, although there is no water with which to irrigate. We passed by an old grandly walled town, a monument of Chinese brick masonry, every line and angle in perfect symmetry. We had never been told enough of the Chinese as architects, as designers, as masons, as builders, as engineers. The entire interior of this walled town, which probably resisted centuries of Mongol attack from the north, is virtually deserted, very likely because infested with disease and with vermin, but a new Chinese town is springing up about a quarter of a mile distant.

From this point, where we rested to cool off and enjoy some fruit, there begins a sharp and rocky ascent to the summit of the pass, the ancient border between China and Mongolia—an




*American Museum of Natural History and Asia Magazine*

This map shows the line of the Kalgan-Urga Telegraph that flanks the route over which Professor Osborn and his companions, Messrs. Andrews and Young, traveled from Kalgan to the Museum camp at Irdin Manha, and thence to the fossil site of Iren Dabasu, 21 miles beyond. The roads were bad from Kalgan to Miao Tan, 35 miles; extremely variable from Miao Tan to Pang Kiang, a telegraph station, 139 miles; perfect from Pang Kiang to Iren Dabasu, in the eastern part of the Desert of Gobi, 87 miles—a total of 261 miles from Kalgan to Iren Dabasu. Iren Dabasu, signifying "Valley of the Salt Lake," is the chief spot indicated in the *Encyclopædia Britanica* map of the Gobi Desert of Mongolia

ascent where the stoutest automobiles are put to the severest test, because of both the grade and the terrible character of the road. We climbed slowly upward through the dust, but in the wet season no automobile can make this ascent. It is highly distinctive of Chinese civilization, past and present, that this people is blind to the value of roads as civilizing media and as channels of distribution for agricultural products. Roads were built only to the tombs and palaces of the emperors. The automobile is now welcomed on the single Kalgan-Urga route over the pass because the heavy *tuchun* tax on this vehicle enables the local military magnate to make a pretense of keeping

*American Museum of Natural History and Asia Magazine*

A section of the dry river bed north of Kalgan under a cliff crowned by a Chinese temple. Beyond rises a hill surmounted by one of the outer Chinese walls. The stern rock hill in the center and right of the picture is of Jurassic porphyry, the result of a series of volcanic flows, now tilted steeply up. The lower hills to the left of the hard rock are wholly composed of loose gravel. In the upper beds of these were found sands containing real "dragon" bones—dinosaurs. Photograph by Roy Chapman Andrews

*American Museum of Natural History and Asia Magazine*

These stout walls of an ancient Chinese city doubtless repelled Mongol attacks from the north throughout centuries. They still stand,—a memento of the past but serving today no practical purpose, for the city they guarded is deserted, while the tide of invasion has reversed itself, and the Mongol military pressure of old is being replaced today by the peaceful penetration of Mongolia by the Chinese. Photograph by Roy Chapman Andrews

*American Museum of Natural History and Asia Magazine*

Eastern side of the crumbling frontier wall between northern China and Mongolia, with a ruined watchtower in the center. Just beyond, as one looks into Mongolia, one may see the rich agricultural lands of the Chinese colonists. Photograph by Roy Chapman Andrews

the road in order. The Chinese carts with shining steel-studded wheels are forced aside into their own rutted roadways, through which men and animals struggle along, for a single train of Chinese carts would completely destroy even the rudimentary motor road that extends from Kalgan seven hundred miles north to Urga.

Reaching the summit of the pass at one o'clock, we were faced by the ruins of one of the outer walls guarding the passage from the Mongolian plains north of the mountains to the great plain of China on the south. To the right of the narrow road are the ruins of a tall watch tower and to the left the "Temple of the Gateway," which contains three once formidable and revered gods of war, somewhat dilapidated now as a result of the wave of irreverence for ancient deities which is sweeping all over the Celestial Empire.

Infinitely more impressive is it to look southward from the temple over the rich and fertile plains of Cathay and imagine the hardy Mongol conquerors clambering over or breaking through the wall, descending with little resistance to pass the line of fortifications which culminated in the Great Wall fifty miles to the south. The hardy and warlike Mongols have always held in contempt the peace-loving agriculturists of China, and even now the Mongol saying runs, "One Mongol is good for ten Chinamen and a Mongol troop of 300 is amply able to rout a Chinese army of 3000." In fact, in 1921, not far north of this barrier, which has been crossed and recrossed so often in the past three thousand years, the entire Chinese army was virtually annihilated, the few straggling remnants being driven back by Mongol troops armed with Bolshevist weapons.

The present peaceful invasion of Mongolia by China is, however, far more formidable than the warlike invasions of the past. The Chinese farmer is pushing northward the Mongol herdsman and horseman, just as the American farmer and settler

slowly pushed back the Indians of North America. This agricultural invasion is irresistible; it is at the rate of from five to ten miles a year, along a very broad frontier, which has now reached a point between eighty and ninety miles north of the actual geographic line between Mongolia and China. The advancing invader is the adventurous Chinese with his plow; he goes well beyond the nearest Chinese settlement, selects what seems to be a promising piece of land, throws it into furrows, and plants the first crop of seed that has ever been put into this virgin soil, which the nomadic Mongols have used for thousands of years as grazing grounds. The next year the Chinese officials take over the land and establish corner posts, and in another season the Mongol *yurts* slowly disappear and Chinese mud-walled towns suddenly spring up. The present Chinese invasion, it is said, extends at least 125 miles east and west and from 50 to 80 miles north and south, constituting an area of not less than 6000 square miles.

Nowhere is there a more startling transition than that presented by the landscape as one leaves the terribly arid hillsides of northern China and, passing through the barrier wall, finds himself among beautiful, richly fertile slopes and fields, superbly cultivated. The melting snow of the preceding winter starts the crops in spring; then there is a period of drought, followed by an early autumnal rainy season. As we rolled along, passing entrancing golden fields, we were pelted by a heavy shower of hail, exactly as in the uplands of Colorado and Wyoming in the midsummer season. The roads are almost perfect and we bowled along at thirty-five miles an hour, reaching the important Chinese motor car station of Miao Tan at half past three, which gave us an opportunity before dark of studying a typical Chinese frontier town, into which the Chinese peasants retreat from their widespread fields at nightfall for protection. The harvest was in full tide. Women stumped along on their diminutive bound feet, for this region has not been penetrated by the foot reform wave. Chinese mothers do not want to jeopardize the future matrimonial prospects of their daughters by allowing their feet to attain a natural size, the small foot being one of the emblems of feminine beauty even in this farming community. Some of the women and girls, though moving about as if on stilts, appear to have overcome the pain entirely; others, their faces drawn, show that they are life-long sufferers from the mandates of this strange fashion.

Returning from the fields under the brilliant rays of the setting sun—the first of the incomparable Mongolian sunsets which greeted us—we had splendid appetites for our first truly Chinese dinner, and the doorway to the guest room of honor seemed most inviting even though the square windows of the room were covered with paper instead of glass, thus affording poor ventilation.

It was represented to our Chinese host in the inn of Miao Tan that the party was headed by no less a personage than the president of "the American Museum of Heavenly Creations," a man who had come an immense distance and must be duly impressed not only with all the delights of Chinese cooking but with the exotic comforts to be found between the baked-mud walls of the principal guest room, where one's bed is placed on top of the Chinese oven before the fire is kindled within.

But the dinner was a simple one compared with the elaborate banquet prepared for us at this same inn on our homeward journey a week later, because on our departure for the north the host was duly warned that when we returned there should be such a dinner as had never been served before in this inn.

This great feast on our return to Miao Tan was celebrated on the evening of September 19, when the entire fleet of automobiles was rolling southward. I may be permitted to digress for a moment in order to stress some features of that return trip. Andrews and I arrived in advance of the fleet and found the courtyard pretty well crowded with three northbound Russian-American motor cars, including an imposing French double-tired truck, utterly unfit for Chinese furrows or Mongol road bogs. It was evident that the cars were terribly overloaded and that, with a very rudimentary knowledge of motor construction, the chauffeurs were more intent on making loud explosions and thereby creating a great impression on the Chinese than in the care of their machines. One of these cars, with twelve northbound Chinese passengers on top of its load of freight, started out of the yard to the accompaniment of loud engine explosions, carrying with it a considerable part of the gateway. At this moment my American heart throbbed with pride as I heard the familiar toot of our own motor fleet and there swept into the yard in perfect order and at a rapid rate our two Fulton trucks and three Dodges, grandly driven by their bronzed, blue-eyed giants, J. McKenzie Young and C. Vance Johnson. The cars lined up side by side in military order, and for the remainder of the afternoon prestige was entirely with us. By their majestic and well-timed entry our motors had taken all the "face" out of the other cars. The yard bustled with life—motor men, Chinese attendants, Mongols, little Chinese soldiers, and dogs full of curiosity; while from the paper windows of the Chinese kitchen there were wafted the most delectable odors of roast pig, mingled with the acrid fumes of the camel-dung fuel. And never was there such a dinner as that celebrated that evening, with libations now to the gods of Mongolia, now to the American men of the expedition force, now to the president of the "American Museum of Heavenly Creations."

At the Chinese inn in Miao Tan.—Professor Osborn in the doorway of the mud-walled room reserved for distinguished visitors. Photograph controlled by the American Museum of Natural History and *Asia* Magazine

To return to our northbound journey. We were off before sunrise in the

morning and soon passed the northern boundary of the Chinese agricultural lands to enter the hilly grasslands, where the Mongol herders still are to be seen with their horses, sheep, and goats, and where one must be on the lookout for bandits. This hilly country is probably the remnant of a once grand mountain chain, from the southern slopes of which were eroded the rich agricultural rolling plains now in possession of the Chinese, while from the northern slopes were deposited the fossil beds. A traverse of 139 miles brought us to Pang Kiang, where the single mud-built inn was so uninviting that we pitched our tent amid the ruins of a Chinese fort, from which the Mongols had driven the retreating Chinese army nearly three years before. The fortifications had been erected with military skill. They included earthworks of modern type designed by German engineers and proudly surveyed as impregnable by Chinese soldiers marching with the German goose step, so that the safeguards against Mongol attack were faultless—if only the Mongols had followed the orthodox methods of war and attacked from the front! But, greatly to the bewilderment of the Chinese soldiers, they violated all established rules and swept around the forts, attacking from the rear. It was a series of infantile military blunders of this kind which led to the destruction of the Chinese army.

We could not greatly regret the outcome, because we were in a country which we felt belonged historically to the Mongols, and under a glorious sky, in which the stars seemed so near that we could almost touch them, we made

*American Museum of Natural History and Asia Magazine*

Roy Chapman Andrews, chief of the "American Men of the Dragon Bones," in the Desert of Gobi, pointing out Iren Dabasu, "The Valley of the Salt Lake," where the first dinosaurs were discovered in Mongolia in the season of 1922. Photograph by Walter Granger

our way through the darkness toward the little telegraph station of Pang Kiang, which is at once a sanctuary for the caravans and a point of communication with the outer world.

As we walked, I suddenly noticed a small group of men in the darkness pointing toward Andrews and myself. I asked Andrews to listen to what they were saying, and it was here that I learned the Chinese designation of our party, for the words were "*There go the American Men of the Dragon Bones.*" This did not impress Andrews as it did me; I was delighted with this Chinese christening, because it seemed to me both a tribute to the valor of our men and a wonderfully apt designation of the main objective of the Third Asiatic Expedition as it impressed itself upon the Chinese. For what purpose were we in Mongolia? Obviously enough to the Chinese mind, to collect the bones of dragons—the dragons which for ages past had ruled the sky, the air, the earth, the waters of the earth, and which even today are believed in implicitly by the Chinese. Of course we should find small bones corresponding to small dragons, large bones corresponding to remains of large dragons —also of vast dragons, some of which according to Chinese myth leave their tails in the eastern part of the Desert of Gobi, while their heads rest on the slopes of the Altai Mountains, four hundred miles distant! Here is the sum of the palæontology and zoölogy of the native Chinese—the dragon and the phœnix. Unlike the dreaded dragon of western Europe the dragon of central Asia is a beneficent creature, a friend of man, which brings the rain to produce crops and in turn supplies food. This creature is, in fact, so highly revered that one of the most sacred titles bestowed upon the emperors was "the true dragon." Consequently, I felt that the giving of this title to the American Museum expedition was a mark of reverence and respect, both for the animal whose bones were sought and for the men who could pursue such a difficult and adventurous calling.

The rosy hues of dawn were tingeing the sky next morning as I left my blue tent, and soon we were again under way. Before us was the line of rolling hills which intervened before we reached the borders of the desert; our motor car quickened its pace as it sped along the uplands. There were valleys leading outwards, no cañons, only broad flat basins surrounded by low-rimmed hills. This was a revelation to an eye accustomed to the well-drained cañon basins in Wyoming, Colorado, and all the Rocky Mountain region. These flat basins are, however, the geographic key to the southern borders of Mongolia—in fact, to central Mongolia itself. The water supply is so scanty that it sinks into the soil and never accumulates in lakes and rivers to cut its way out; the water is never seen, but lies in quantity below the surface, so that it can be reached everywhere by wells. These have been dug by the nomadic herdsmen for thousands of years past; from fifteen to twenty feet below the surface an abundant supply of pure water may be found, and on this the domesticated herds of camels, goats, sheep, and horses have always depended. In the Rand-McNally map of Mongolia the numerous little circles indicate these wells as mapped by the Russians and are not symbols for towns or villages as one would suppose. It is only in the height of the very brief rainy season that pools occur on the surface; con-

sequently, all the wild animals have become accustomed to a waterless desert and live on the moisture they find in the plants.

We soon entered the southern borders of the great Desert of Gobi, which I have always desired to see above all deserts, especially after traveling in the Libyan Desert flanking the Nile Valley of northern Africa and in the desert wastes of the Rocky Mountain region. We passed on to this vast Mongolian desert, incredibly level as far as the eye can reach, and before long sighted our first herd of antelope or gazelle, of the species *Gazella sub-gutturosa*, and immediately gave chase. Although the speed of the car rose from thirty-five to forty, then to forty-five miles an hour, the gazelles easily kept their distance on the absolutely level plain. They went through the manœuvre of crossing in front of our car, after the manner described by Andrews in his volume *Across Mongolian Plains* and elsewhere,—a trait also of the wild asses when pursued. Andrews, who at that time had replaced Young at the wheel, drove the car with incredible skill, as if by instinct. "This is just the ordinary speed of the gazelle," he said, "I'll throw them into top speed by a rifle shot." He then fired and a fleck of dust marked the plain just to the left of the herd. Then I witnessed a wonderful mechanical change; the whole herd flattened down into an entirely different speed, which Andrews estimated at sixty miles an hour by taking into account the ease with which the animals ran away from our car traveling at forty-five miles an hour.

Altogether we had this exciting experience three times; on the third occasion near our Irdin Manha camp, when we were going at a high rate of speed, the gazelles crossed in front of us, making for a break in the plain to our left. Andrews suddenly slowed down to avoid a dangerous gully and as he swung around to the head of the gully, we witnessed a very rare sight: a gazelle that had dashed away from the herd reached the edge of the break, whereupon a wolf sprang out from its place of concealment and, quite oblivious of our presence, made a tremendous sprint for the gazelle, which was already somewhat fatigued by our previous pursuit of several miles. It was an exciting moment; in another instant, however, the two animals swept around the break out of sight and we could not see which creature won out in the struggle for existence.

At three o'clock on September 15 we witnessed another unusual sight: a camel caravan of four great divisions, with more than a hundred camels in each division,—420 in all. It was majestic. Throughout his experience in Mongolia Andrews had never seen a camel train equal to this in size, stretching for two miles in perfect alignment. It was a fitting introduction to the climax of this first step of my journey, namely, the approach to the American Museum camp. Andrews, who well knew its location on the edge of the great Irdin Manha plateau, told me that we were nearing it, but it was concealed by a glassy mirage, and it was only when we came within a mile of the camp that the American flag and the blue tents were discernible in the distance. We were now going at a very high rate of speed and in a few moments *I was there*—after two years of enforced delay!

All the men were drawn up in line to welcome us—six Americans, nine Chinese, four Mongols; part of our Mongol section was still with the camel

*American Museum of Natural History and Asia Magazine*

Motor trouble on the Mongolian plains at Irden Manha.—The rear housing of Dodge car No. 2, strained from overloading and severe jolting, is being straightened by C. Vance Johnson, chief mechanician, over a fire of camel dung. From left to right: C. Vance Johnson, Peter Kaisen, George Olsen, Professor Osborn, J. McKenzie Young, Albert Johnson. Photograph by Roy Chapman Andrews

*American Museum of Natural History and Asia Magazine*

The Mongol interpreters of the Third Asiatic Expedition.—Two of them are proudly dressed in American clothes in anticipation of the return to their homes at the close of the field work of 1923. The individual on the left is Tcherim, strongly of the American Indian type, courageous and loyal, a keen huntsman and fine example of the best unspoiled native Mongol. Photograph by Roy Chapman Andrews

*American Museum of Natural History and Asia Magazine*

**A CARAVAN IN THE GOBI DESERT**

The Mongols always ride their camels; they never walk. Consequently, even at a great distance it is easy to distinguish a Mongol caravan from a Chinese, in which the driver is always on foot. The Mongols do not like to have their photographs taken but Professor Osborn halted one of the sections by offering the leader a cigarette, a most coveted delicacy in the desert. Photograph by Roy Chapman Andrews

caravan from a Chinese, in which the driver is always on foot. The Mongols do not like to have their photographs taken but Professor Osborn halted one of the sections by offering the leader a cigarette, a most coveted delicacy in the desert. Photograph by Roy Chapman Andrews

*American Museum of Natural History and Asia Magazine*

PROFESSOR MORRIS WITH HIS GURLEY PLANE TABLE

The edge of the plateau at Shara Murun forms the horizon line. In the badlands was found one of the richest deposits of dragon bones in all the Gobi, including titanotheres that resembled rhinoceroses and lophiodonts that were like small tapirs. Photograph by Walter Granger

*American Museum of Natural History and Asia Mi*

The expedition headquarters from which Professor Osborn set forth to Mongolia and to which he returned after his adventures in the desert. The picture represents a corner of the front court, and a glimpse into the Chinese rock garden beyond. The building in the center is Leader Andrews' office. Photograph by Yvette Borup Andrews

caravan on its way from western Mongolia. Every man showed his joy at the arrival of "the president." I shook hands in order of seniority—with Walter Granger, veteran palæontologist for thirty-two years in the service of the American Museum; with Frederick K. Morris, geographer and geologist, formerly of Columbia University; with Peter Kaisen, sturdy fossil-bone expert, whom I found thirty years ago in central Wyoming; with George Olsen, another sturdy Dane and, like Kaisen, a native of Medicine Bow, Wyoming, scene of Owen Wister's novel, *The Virginian;* with Albert Johnson of Sweetwater, Montana, "Montana Johnson," also an expert bone man. These with C. Vance Johnson, former United States marine and now first mechanician under J. McKenzie Young, and Young himself, who drove us out, completed the party of "American Men of the Dragon Bones."

This was one of the really great moments of my life, to see these men in splendid health, each bursting with some triumph in the way of fossil discovery, each modestly giving all the credit to his fellows. After a glorious sunset that gradually gave way to a

*American Museum of Natural History and Asia Magazine*

Within the front court of the headquarters of the Third Asiatic Expedition.—The ivy-crowned entrance leads to the spirit door beyond, in the sun-lit distance. The spirit screen, which closes the view, stops the invasion of ghosts, for in China spirits can travel only in a straight line. Photograph by Yvette Borup Andrews

wonderfully clear starlit night and the superb brightness of the Mongolian moon, we drew into our large Mongol dining tent and feasted on a delicious dinner of roast gazelle, sirloin cut, with a tenderloin cut for "the chief." As I looked around the table, feebly illumined by a central line of candles, I observed even by the dim light what I have noted in the case of other groups of explorers—all the hunters of the dragon bones were blue-eyed; whether from Denmark or from Wyoming or Montana or Vermont or Wisconsin, all were of the same adventure-loving northern exploring stock. This observation, followed by a large slice of tempting pumpkin pie cooked over a tiny Mongol brazier with unrivaled Chinese skill, sent me to bed with the happiest thoughts, chief of which was the complete success of the Third Asiatic Expedition under its incomparable leader, Roy Chapman Andrews.

### THE RETURN JOURNEY

The three following days were devoted to a rapid review of the three great fossil fields which lay to the north, to the east, and to the west of our Irdin Manha camp. In the meantime the last specimens were taken out of

the various quarries, the packing boxes were closed up, a final overhauling was given the machinery of the five automobiles, and on the morning of September 18 we started on the long homeward journey to the American Museum via Kalgan and Peking. On the afternoon of the same day, the fleet rolled into camp in the hilly country on the border of Mongolia and China, which is more or less infested with bandits. It was splendid to see the cars run into position, each in its place, and the men spring out to create the camp. Although the men were simply following the usual instructions, I was struck by the rapidity of their work and took out my watch to time them. At quarter to five the fleet came to a stop; at two minutes past five seven blue Mongol tents were lined up in order, ready for occupation—exactly seventeen minutes.

Suddenly we discovered that we were accidentally camping on a Mongol cemetery, consisting not of graves but of skeletons and skulls,—remains of the bodies thrown out to the dogs according to custom but which were none the less sacred to the natives. Our men began to bring in some of the skulls, precious in their record of pure Mongol traits; they were immediately stopped by Leader Andrews, who was aware that our party could do nothing more calculated to hurt the spirit of Mongol reverence for the dead, which is not less than that of the Chinese.

This spot among the hilly grasslands was also the site of the first American Museum camp in Mongolia, as it was there that the expedition made its initial halt in April, 1922. In high spirits we all assembled in the large blue Mongol mess tent, and after our pipes and stories we turned into our respective tents for the night. At this moment I observed four men approaching through the darkness with rifles, obviously not peasants. Were they soldiers or were they bandits? We did not know, and it was not a moment to take any chances, because the surrounding hills would have facilitated a bandit attack. As I stepped out in my pajamas, Andrews emerged from his tent, his revolver in his right hand and in his left an electric flashlight, which he gleamed in the faces of the approaching armed Mongolians. Out of every tent at the same moment emerged a peace-loving American, each similarly equipped with a revolver and flashlight. Andrews is known as an absolute dead shot with his revolver; he occasionally practises in camp on cans and other small objects, and the Mongols far and wide know that he never misses. A reputation for accuracy and steadiness of aim is very helpful. As in every other case of this kind, a show of preparedness was all that was necessary; Andrews waved his hand across the flashlight and the approaching band immediately put down their rifles and thus became harmless. One of our Mongols then went forward and friendly relations were soon established.

It was this combination of firmness and kindness during eight years in northern China—three of which were devoted also to eastern and central Mongolia—which resulted in an ever-increasing respect for the power of "the American Men of the Dragon Bones" and an ever-increasing welcome as their honest purposes and peaceful methods became more widely known. When our fleet of motor cars returned on September 20 through the narrow, dusty streets of Kalgan, with small American flags weatherworn from long exposure to the hot sun and sand of

the Mongolian desert, the Chinese were confirmed in their impression that we were friends on a friendly mission, friends always ready for a critical emergency along the way or to do a deed of kindness, but not to be trifled with by bandits or outlaws.

Our methods have also won for us the respect and friendship of officials and men of prominence throughout China and Mongolia. When our privilege to explore was seriously challenged in the spring of 1923, Leader Andrews renewed his pledge to the Mongol government that in case of a discovery of economic importance—coal, oil, or other mineral wealth—it would first be communicated to the Mongol government and not to American or foreign corporations. As interpreter of the goodwill and of the determination of the expedition to thrust its way through unknown Mongolia, Mr. Franz A. Larsen, of Urga and of Kalgan, has for three years been giving his staunch support; he is now enrolled as one of the honorary life members of the American Museum. Also on the roll of life members of the American Museum is the name of Mr. C. Badmajapoff, Minister of Justice of the Urga government, who is friendly because he is thoroughly convinced that we are working entirely for the welfare of his country. Through the combined efforts of Mr. Larsen and Mr. Badmajapoff we were able to prevail over counter influence in Urga and to penetrate during the first and second years to Outer Mongolia, the northerly and westerly desert, where the most startling discoveries were made, namely, of the giant *Baluchitherium* and of the great horned or ceratopsian dinosaurs and their nests and eggs.

As the result of a long evening conference I had with Mr. Larsen, measures were planned to assure the success of our coming five years of exploration, 1924–28, to obtain a continuance of Mongol support, and to cement the friendship of the Mongol government. We examined Mr. Larsen's Kalgan compound and assured ourselves as to the safety of boxes 1 to 35—the early numbers of the great total array of 135 boxes of fossil riches which have slowly made their long journey from western Mongolia across the Pacific through the Panama Canal to New York. One cannot examine these converted Standard Oil boxes with their delicate fossil freight packed in camel hair without a thrill over this American and Mongolian romance, this new bond that connects the young, eager, expert explorers of America with the most venerable dominion of Mongolia.

Irdin Manha, with the flag-topped encampment of the Third Asiatic Expedition

*American Museum of Natural History and Asia Magazine*

**WINTER QUARTERS IN SZECHUAN PROVINCE**

The white-walled building which rises above the roofs of the clustered houses of the village of Yen Ching Kao is the ancestral hall of the Tan families, where Mr. and Mrs. Granger and their Chinese assistants spent the winter. The grandeur of the surrounding mountains makes the human habitations huddling together in the valley seem tiny by comparison

# Wintering Over a Fire Basket in Szechuan[1]

By ANNA G. GRANGER

Third Asiatic Expedition, American Museum and Asia Magazine

FOREWORD.—The fire basket (*huo lant zu*) of China is a wicker-encased clay pot containing glowing coals. Held between the knees, its warmth helps one forget that the thermometer stands at 28 degrees above zero and the mountains are snow-covered. As the hearth is used symbolically for the home, so in the title of this article the fire basket epitomizes the quaintness yet attractiveness of that substitute for home which Mr. and Mrs. Granger found in a Chinese ancestral hall in Szechuan Province. Mrs. Granger's article in the March-April issue brought the reader almost to the threshold of this building; he is now invited to step in.

HOWEVER much one may inveigh against the political and climatic conditions of Szechuan, no one can gainsay its scenic beauty. The tiny settlement of Yen Ching Kou (Salt Well Valley), where the American Museum camp was located, had for its setting high, rounded mountains, cultivated slopes, and glistening rice paddies. Under the magic of the sun's rays, no more charming spot could be imagined, but even when viewed through the almost constant mists, it was impossible to have other than a friendly feeling for the pleasantly undulating ranges, or to take seriously the smaller isolated cones that have come into existence at odd places in seeming defiance of natural laws. Whether these conical mounds really presented any geological problem to the "chief of staff," I know not. To my mind they were simply a caprice of nature, and enjoyed as such. A bona fide phenomenon did occur in the vicinity, though. It was a spring of cold water issuing from under the floor of a small cave and emptying into our valley brook. You could pass it one hour and the flow would be mediocre; a little later, and the volume would be increased tenfold, only to fall back again after a few minutes to the original amount. As yet this intermittent action is unexplainable. The Chinese long ago noted the spring's strange conduct and built a charming temple close by, which is dedicated to all flowing waters and commemorates their beneficence to mankind.

The mountains in this region would naturally have been clothed with a dense and somber growth of evergreens if the pine and a species of cedar or arbor vitæ which grow thickly had been left to flourish as nature intended. Where these surround a temple or a burying ground, they are usually respected, but elsewhere Chinese squeeze enters in and they are robbed of their branches as high up as it is safe to climb. The result of this pruning is a shape strongly suggestive of the imitation fiber trees that come with a child's set of building blocks, except that the triangle of green which is silhouetted against the sky, or mirrored in the paddies, is elevated on a proportionately taller trunk. The effect when the trees stand alone is by no means unpicturesque, and when they are massed a degree of airiness is attained, which would be less pronounced were the light not able to penetrate to their bases. Also, it seemed to me that the presence of so many surfaces of water at high levels assisted in creating a more luminous atmosphere than is usual under gray skies.

Two other trees helped to maintain a cheery, all-the-year-round greenness in this neighborhood. These were a

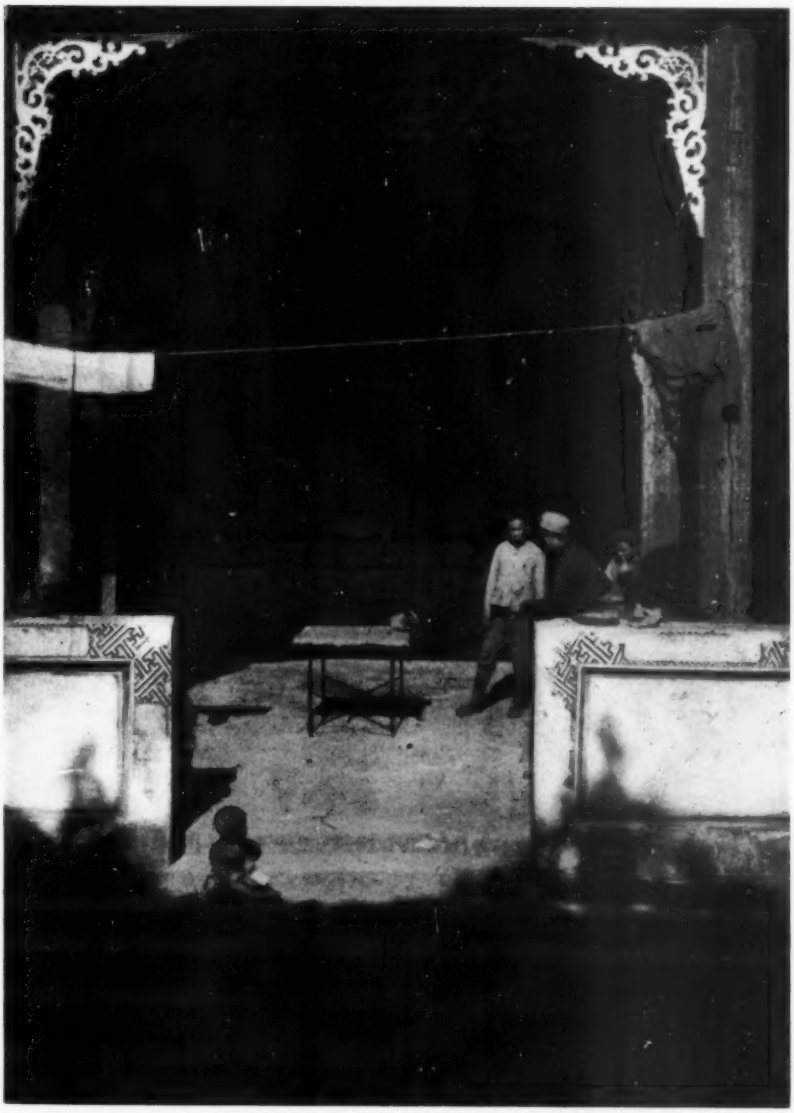
[1]Photographs accompanying this article were taken by Mr. Walter Granger.

*American Museum of Natural History and Asia Magazine*

The square stage that faced the altar platform on the opposing page.—The stage served as laboratory and office, as dining room and conning tower. To the left of the picture, beneath the gallery are ranged two or more empty coffins, which, according to Chinese custom, are selected by their future tenants while still in the flush of life and reserved for use on the inevitable day

species of palm and a bamboo. The latter is highly esteemed, and with good reason. Its grace is beyond compare, it can be cut and cut and still sprouts out anew, and its uses are endless. No farmhouse tucked away up on the mountain-side on its man-made platform of stones is without a cluster of these sunny-stemmed, feathery trees. Had it not been for these plants, the sight of the white-plastered, dark timbered buildings, often with thatched roofs and bearing the general form of a Swiss chalet, might almost have persuaded us on a snowy morning that we were spending the winter in Switzerland rather than in Asia on a parallel a little north of the city of Cairo.

All this scenery was lost to view once you stepped inside the Tan families' ancestral hall. The structure boasted only two round windows and these were placed high up in a deep-set wall and covered with a fretwork which, while delightfully ornamental, rendered them utterly useless as a means of observation. What light there was came from the uncovered court in the center. The plan of the roofed portion was very simple. A square stage, supported on high pillars, jutted out into the court over the entrance. Opposite this was a platform given over to the practice of ancestor worship. An altar and tablets inscribed with eulogies to the departed were placed against its rear wall. Here Mr. Tan, the innkeeper who lived next door, came every



*American Museum of Natural History and Asia Magazine*

The altar platform in the ancestral hall, with the tablets eulogizing the departed placed against the rear wall.—On the table is the camp pet, a bamboo civet (*Paradoxurus*) that interested visiting children of the neighborhood

morning and evening to light fragrant joss sticks, to beat a drum, and to draw bell-like tones from a bronze urn by taps with his wand. Ordinarily this little ceremony seemed a very pleasing way of saluting the rising or departing sun. To him it meant essential gain in the amount of "acquired merit" necessary for peaceful rest in one of the wooden coffins which already awaited the family in a row under the gallery. It was only when this devotion led him to set off a small-sized cannon at break of day during the New Year festival period that we weren't so sure of our enthusiasm for this ancient custom.

These airy graceful trees, with their feathery tops, are characteristic features of the landscape. The natives lop off all but the highest branches for fuel, leaving the trunk denuded of verdure. This picture is controlled by the American Museum of Natural History and *Asia* Magazine

To reach the stage one crossed the court, ascended seven stone steps to the altar platform, turned either to the right or left, mounted a ladder of four rungs, and traversed either one of the two galleries which connected these main sections. At each end of the altar platform was a small room. One of these was used as our No. 1 boy's apartment, and the other made a very dark kitchen. Back of the stage were two spaces rendered partially private by some openwork wooden grills of interesting pattern. These served as bedrooms for Mr. Granger and Mr. Wong during the second winter. One gallery was given up to taxidermy and sleeping quarters for the remaining Chinese. The other was utilized for storage of equipment and as a place to keep alcoholic specimens and to spread out the fossils, which always came in coated with wet mud. The stage was Mr. Granger's special domain, but aside from its usage as laboratory and office, it had also to be dining room and conning tower.

Considerable consternation was caused in the Tan family when it became known that I was expected to visit the camp. At first my coming was not going to be allowed at all. A conference of the elders was held and finally a compromise was arrived at. If I would only not sleep in the temple, even though I dressed and ate there, the wrath of the gods would be averted! So it happened that Mr. Granger and I put our cots in Mr. Tan's inn next door and had a chance to see, or rather hear, a phase of Chinese life not originally on the program. In many

A native Szechuanese carrying a baby on his back and a fire basket in his hands. The wicker on top of the basket is strong enough to support an individual seeking warmth and comfort by sitting upon it. This picture is controlled by the American Museum of Natural History and *Asia* Magazine

*American Museum of Natural History and Asia Magazine*

A view from the front of the ancestral hall.—On the top of these mountains are the pits that supply the "dragon bones" of Chinese medicine or the fossil treasures sought by the palæontologist

inns, as Mr. Archibald Little's books will testify, the guest room is situated over the pigsty. Had it been so located in this instance, my trip to Yen Ching Kou would have had to be abandoned. Barring the fact that Chinese never want to stop talking until about one o'clock, that they begin scraping their throats at the first streak of dawn, that a flock of ducks was put to sleep every night in a corridor just behind our heads, and began squawking to be let out at an early hour, and that rats and bats coursed freely through the two doorways of our room, we passed very comfortable nights in these make-shift quarters!

The camp day was usually begun at eight o'clock by Mr. Granger calling out, as soon as we reached the gallery floor, "Get up, Jim!" The response to this sally came generally from the kitchen, where Mr. Wong had been warming his shins for an hour, awaiting this hint of the approach of breakfast! This bit of pleasantry over, *hsi lien shui* (wash-face water) was demanded and in a few minutes we three were enjoying as nice a meal as if we had been in Peking, with the additional treat of a variety of persimmons much superior to those grown in the north. The Szechuan fruit is smaller and shaped somewhat like a very large plum, and is extremely sweet and juicy. (A foreigner eats it by cutting a thin slice off the top and scooping out the soft contents with a spoon.) Coffee, cereal, eggs, pancakes followed each other in courses. A hard life, we called it!

In the intervals between expeditions to the bone pits, which during this

second season were a long distance from camp, or when the weather was too wet to make a trip practicable, Mr. Granger busied himself making up the smaller, more difficult bird skins. With the thermometer standing in the thirties, a damp wind blowing, and no sun to give warmth, this was a chilly business. When his fingers got too stiff, a walk was in order so as to restore circulation, but he would never desist from his labors until he had finished his day's work, often taking the last stitches in a skin and smoothing every feather down to a nicety after Chow had brought out the supper lamps. Sometimes the wind blew out their small flames before the label was written and the wee thing wrapped in its blanket of cotton. I never tired of watching this skilled performance. Buckshot, Chi, and Mr. Wong were the ones who kept the supply of bird specimens going strong, the interest being stimulated by the attractiveness of the birds and the ease with which a new species could be obtained. So keen were we all to see the new additions that the returning hunters were questioned as to their success before they were half way across the temple court. If the report was an "aye," even the cook joined the eager circle while the game bag was being examined.

We shall not soon forget the day that one of the Chinese brought in a bird which more nearly resembles our American hummer than anything else. Its flame-colored throat gleamed so brightly that not one of us could forbear to pass a finger over the spot as if to assure ourselves that the feathers were not really on fire. A marvelous purplish blue on the back of its neck next attracted the eye. Everywhere else an iridescent green shimmered, and its little body was appropriately terminated by two slender green tail feathers, carefully sharpened to tiny points.

It must be understood that in renting this temple for museum purposes, it was not expected that the native population of the village would be prevented from coming into the lower part of the enclosure as long as they didn't make any noise. The one exception we made was at meal times. At other hours the altar steps were rarely without a group of curious onlookers. Most of what they saw must have been a great puzzle for their untutored minds, but at least our being there brought a break in the frightful monotony of their lives.

After breakfast usually the first people to appear were the patients to whom "Doctor Chow" was giving first-aid treatment for sores of various kinds, many of them the result of dog bites. The weaver might be the next to fill the space on the altar floor with an apparatus for winding his spindles, or with some large skeins of white cotton to be dipped in a stiffening solution and hung up to drain. The dyer had found that a long bamboo pole placed under the eaves of the gallery roof made a fine place from which to suspend his freshly dipped pieces of blue coolie cloth. Idle curiosity brought many to see the *lao tài tài* (old mother), as I am always called by the Chinese. Most of the inhabitants had never seen a foreign woman before. In the town of Wan Hsien I was one of three English-speaking women. When the wives of the gentry came, Mr. Tan made no objections to their mounting the stage to have a closer look at me. My tan leather walking shoes and my many layers of wool clothing interested them, while their cleverly embroidered cotton suits and fancy hair ornaments were no less entertaining to me.

The biggest commotion was caused when a farmer on whose land a bone pit was being exploited arrived with some baskets of fossils which he hoped would be salable and Mr. Wong was hurriedly summoned to do the interpreting, to oversee the process of weighing (they are sold at from $18 to $23 a picul—equal to 133⅓ pounds—depending on the quality of the bones and the amount of mud and rocks adhering to them) and to advise as to how much *cumsha* above the sale price it would be proper to give so as to encourage the bringing of more material.

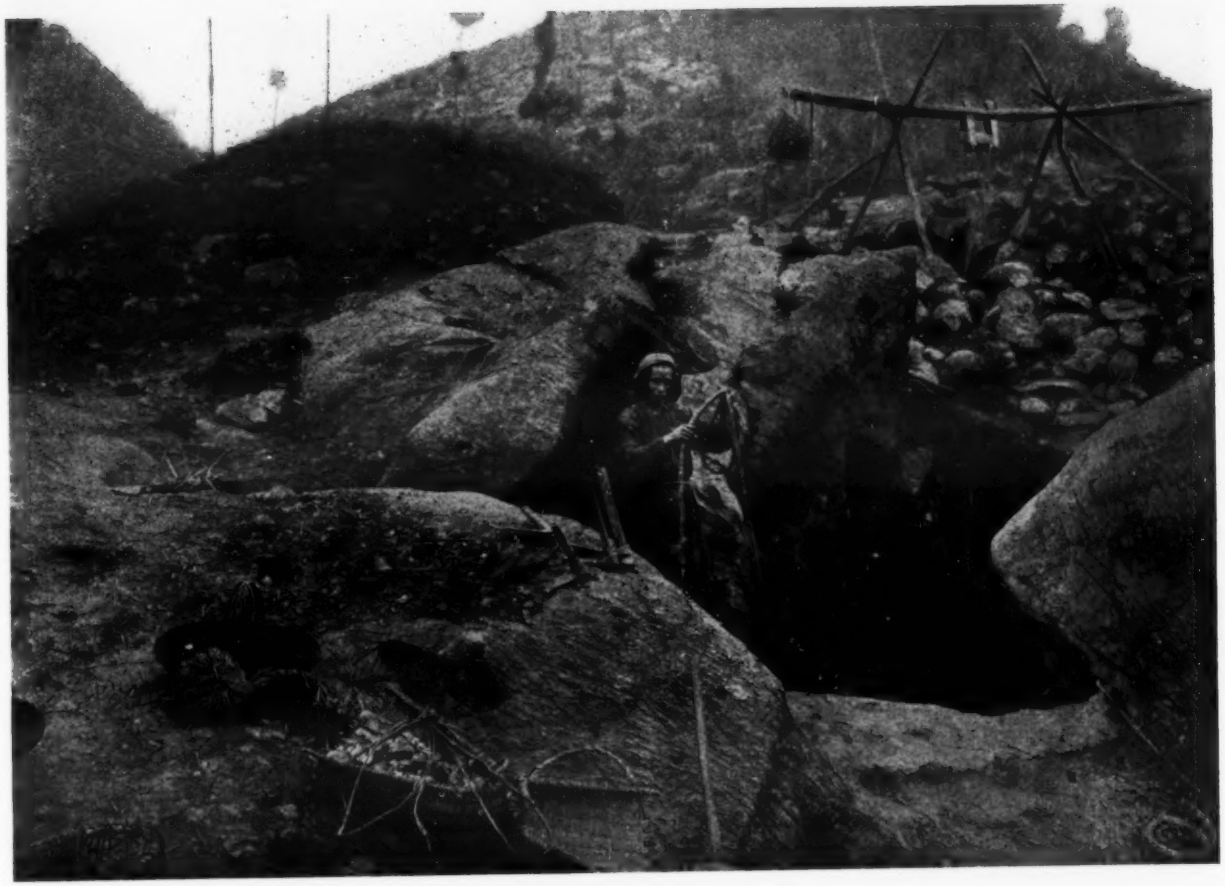
During my first visit of twenty-eight days at the camp the sun shone brightly for three whole days and as many half days, a better average than the winter months of some years show. Mr. Granger grew so tired of writing in his diary "cloudy, cold, and damp" that he said he fully intended having a rubber stamp made of this legend, should the Fates ever send him to Szechuan again! When a warm bright day did come, the villagers turned out *en masse* to make a thoroughgoing investigation of the live stock that had accumulated on their persons since the last sunshiny day! At our camp also unwonted activity appeared in the line of laundry work and bed airing, and the opportunity was not lost for taking and printing pictures and for giving our own selves the chance of a sunning.

On the first favorable day I was taken to see some of the nearest bone pits, a half-day's journey from the temple. They lay in some high uplands on the farther side of the range of mountains in sight from our front door, and were reached by a trail of stone steps which for steepness left nothing to be desired.

It was still early in January. Patches of snow lingered from the fall a few nights previous and a genuine holiday atmosphere pervaded the scene because of quantities of a shrub bearing bright red berries similar to those of our holly. Buckshot had brought branches of these to the temple a week before, when he and I had fashioned Christmas wreaths out of evergreens and had transformed the stage into a semblance of an American home at the Yuletide season.

As we climbed upward we met many carrying coolies coming down with their loads of wood, wood oil, and rice. There was hardly anyone who withheld a friendly greeting, or who would not, with the slightest encouragement, commence conversation, though what it was all about we seldom knew. Mr. Granger would invariably reply with a lingo as completely unintelligible to them. It often took the form of "Hello, Mike! Sure! Same to you!" so that if the speakers had not been polite enough to say something agreeable, their evil thoughts would descend upon them in turn! This answer, delivered in his gay manner, always brought a smile to their earnest, patient faces but I could never help regretting a little that the real humor of the jest from our point of view was lost to their minds. If the natives of Szechuan have, as I believe, the same childlike curiosity that the Chinese population has in Peking, these wayfarers were in all likelihood simply asking us whither we were going, whence we had come, and what our errand was.

By the time twelve o'clock had come round, we had conveniently arrived at a small temple at the entrance to a large cave. Here we warmed ourselves and ate our lunch around the caretaker's open fire while the rice-eating members of the party prepared their



**BONE PITS OF SZECHUAN**

This picture gives a good idea of one of the larger pits and some of the equipment needed in recovering fossils. The apparatus mounted over the pit in the background was used by the Chinese in making their descent into the deep dark shaft, and by its aid they were hoisted out again into the daylight. In the foreground is a basket filled with fossils

This picture gives a good idea of one of the larger pits and [illegible] apparatus mounted over the pit in the background was used by the Chinese in making their descent into the deep dark shaft, and by its aid they were hoisted out again into the daylight. In the foreground is a basket filled with fossils

*American Museum of Natural History and Asia Magazine*

COOLIES ON THE WAY BACK FROM THE BONE PITS

The men are laden with camp equipment and with baskets containing fossil finds. "Buckshot," one of the Chinese assistants of the Third Asiatic Expedition of the American Museum of Natural History and *Asia* Magazine, is in charge of the detail

food over a cement stove in the opposite corner of the kitchen. A wide doorway looked out upon the cave, the opening of which was lined with niches carved in the limestone and set with brightly painted gods, among them one representing the moon and another the sun. A scientific interest attached to the cave on account of the bats which it had yielded in the winter of 1921–22.

Soon after leaving the temple we came upon the first fossil pits. As had been anticipated, none of them were being worked at the time, but these excavations showed as well as any how deep and dark the holes were and how easy it would be for the sides to fall in, since nothing was used to shore up the wall of earth. In diameter a hole of moderate size may vary from four to sixteen feet; the depth, from twenty to sixty feet. Old pits—that is, those that have been worked a long time—are apt to be much wider and deeper. As the pits deepen, water gathers in the bottom, often forcing a discontinuance of work. The darkness of the wells is overcome by the use of tiny wood-oil lamps.

Where, as in some instances, the pits were in more rocky surroundings and the probability of a cave-in less imminent, there was still a strong element of danger in trusting oneself to the frail pulley which was erected over the top, and which served the Chinese as a means of descent and ascent. It looked hardly stout enough to raise the baskets of wet bones. A little later in the winter a report reached us of a workman who had been killed by a collapsing pit, and I was very glad that my usually intrepid bone-digger was willing to use discretion and keep out. The whole region seemed permeated with deep pits, many of which were so disguised by plants and vines that their true nature was not apparent.

To anyone interested in keeping fossil bones whole, and related ones in juxtaposition, the utter disregard of these matters by the Chinese during the process of removal from the pits or afterwards was most trying. Their sole object in digging them was to sell them to wholesale druggists for medicinal purposes, and since the final state of the bones would be powder, why take any particular pains? The number of pits was too great, the areas containing them were too widely separated and the quarries were worked by too many different people to make it practicable to do much in the way of instructing the operators as to the reasons for exercising special care in taking out fossils for the American Museum collection. The situation could have been remedied only by obtaining entire control of the pits, and that was out of the question.

The crowning treat of the day was the view we had as we began the descent to the camp. Never before had it been given me to look down on so vast a sea of peaks as were spread out below us. Had the air been clearer an even larger number would have been included in a picture which, as it was, will always be treasured in my memory as one of the very finest.

My next visit to the camp was in the middle of February and gave me an unusually good opportunity for observing the Chinese during their New Year festivities. The holiday period begins solemnly, with front doors closed and sealed with paper, and decorated with paper emblems. An unwonted stillness is about everywhere. On the second day groups of men and boys are seen playing gambling games at tables set out in the street. The

quiet is broken on the third day by the setting off of firecrackers, and a time of real sociability ensues. Calls are paid and gifts of foodstuffs exchanged,—principally eggs, puffed rice, and a large round rice cake, highly varnished and brightly colored. During this season the more well-to-do people make their annual visit to relatives living at a distance. At our temple members of the Tan family came to offer special joss at the altar. Many of them brought along a present for Mr. Granger, and all were bidden to sit down for tea, sweets, and smokes, dispensed by Mr. Wong, who acted as master of ceremonies. In the village two large feasts were given by families who wanted to do honor to the gods in memory of departed ones. When, in fulfillment of this purpose, the house is hung with embroidered panels and painted scrolls, and men are hired to come to make paper facsimiles of things used by the deceased during life, and priests and musicians are engaged for a period of three days, the expense is large. Although it is easy to understand the glamor surrounding the part of the celebration which took place out of doors under a full moon, when candles and lanterns and sparks from firecrackers were all reflected in the waters of a near-by brook, we should have been better pleased to see the funds used for the purchase of that rare article in Szechuan, a piece of window glass, to lighten the dark homes of the present generation.

One of the chief events of the New Year festival is the arrival of a troop of itinerant acrobats. They appeared in the temple one afternoon at five-thirty followed by the occupants of both the upper and the lower village and everybody from the neighboring farmhouses, who entirely filled the steps, altar platform, and all of the court not actually needed by the performers. Three tables were piled on top of one another to obtain a stage high enough to permit the crowd to see everything well, and to add, as I suspect, a spice of risk for the participants. Part of the show consisted simply of feats of balancing. In the latter half, however, two of the men united in impersonating a lion. This was done by covering themselves with a variegated satin robe to which a huge lion's head with long mane was attached. A few bells sewed somewhere in the folds gave out a pleasant tinkle as the "animal" leaped about, trying to intimidate another man, disguised as a monkey. By six o'clock it became so dark that the manager of the show lighted three pretty, round, swinging lanterns and several four-sided ones set in the top of tall poles, in form not unlike our street gas lamps of some decades ago. These were supplemented by all the lights which the Museum outfit could muster: two carbide lamps and four or five kerosene oil burners. Even at that it couldn't be said that we outshone the Hippodrome! An orchestra of four shrill pieces beat out an accompaniment which seemed to please everyone else mightily, though it was wearisome to us. It was not until seven-thirty that the audience was satisfied and dispersed to their homes. So little out of the ordinary happens in these far-inland places, it is not surprising that the entertainment does not have to be of a very high order to win approbation.

On March 3, I reluctantly returned to Wan Hsien and remained at the Mission that is located there until our final departure from Szechuan. This month was an anxious one for both Mr. Granger and myself. Five days after

my return the war clouds which had been gathering broke, the place where the clash came being about twelve miles from the camp. At this point the defeated Wan Hsien troops cut a dike which prevented the successful Northern army from following their retreat for several hours. This circumstance probably had much to do with the orderly procedure of both armies through Yen Ching Kou. For four days and nights Mr. Granger and Mr. Wong could not relax in their guard at the temple. One night about fifty soldiers were given shelter from the rain in the lower part under the gallery, but they departed at daybreak without committing any depredations. Among the last of the Northern troops to pass by the steps of the temple was a soldier whom Buckshot recognized as a Pekingese by the strong burr of his accent. A friendly exchange of courtesies took place on the strength of their common birthplace and the visit ended by his being intrusted with a letter to me to say that all was well at the camp. I was unable to send out any news of my safety from Wan Hsien because no messenger would contract for the trip on account of the fear of being drafted as a carrying coolie for the new army of occupation. It was not until five days after the evacuation of Wan Hsien that a coolie sent in from the Museum camp (in special uniform to make clear his identity) took back the news that the Mission, though threatened, had been unmolested, and that the military had placed a bridge of boats across the Yangtze a short distance above the city. This was done to facilitate the movement of Northern troops into Wan Hsien, but it very decidedly hindered our plans, for the junk which was to transport us down to Ichang still lay moored at Pei Shui Chi, and it meant a wait of several more days while negotiations were being completed for getting it through the blockade.

All was in readiness on March 22 for the journey down river. Owing to a band of robbers who, reports said, infested a place called P'an T'ou, twenty-five miles below Wan Hsien, it was planned to go only as far as that point the first day, and to remain there overnight under guard of the American gunboat "Palos," Captain Simpson commanding. The junk was a half day in covering the distance. We arrived in time for tiffining with the captain and his officers.

After lunch everybody who could left the ship to amuse himself as best pleased him. Some of the crew played baseball on a wide sandy beach with Captain Simpson and the ship's doctor; others made up a duck-hunting party to a place not far away. A visit to an old temple high up on a cliff on the opposite shore under the guidance of Lieutenant Connolly appealed to us. Dinner on board the "Palos" and afterward a game of hearts finished the day. The weather had been perfect and as we sat in comfortable easy chairs on the forward deck and watched the evening lights fade on a scene which for peaceful loveliness was unrivaled, it was hard to realize that only a week before bandits had popped out from their hiding places and had robbed one of the Yangtze River inspectors of nearly all that he had, even taking the clothing of the crew of his house boat. A luxury which Mr. Granger will always remember in connection with Captain Simpson's gracious entertainment was a chance to have a really-truly American shower bath, with hot and cold water. In fact, there wasn't anything about the

ship that didn't look good to us, and we were loath to leave her side the following morning. The captain's last thought for us was to fill us up with coffee and egg sandwiches, for our own breakfast was to be delayed until we had walked around the Hsin Lung T'an, reached a half hour after getting under way.

En route between Wan Hsien and P'an T'ou a Chinese soldier had begged us to take him with us (he had a message to deliver to an army officer in Ichang) and at Captain Simpsons' suggestion we also took on board as passengers two sailors from the "Palos" who had finished their term of service and were homeward bound to America. This increased our number to twenty-five. When we were all stretched out for the night, there wasn't a great deal of superfluous floor space, and we congratulated ourselves that the weather during the five days of the trip down river was exceptionally good. Had it rained, there would have been little chance for shifting our positions to avoid the leaks in the mat covering.

A sort of boudoir was devised for me by partitioning off, by means of a large piece of canvas, a third of the space in the cabin which occupied the center of the boat. Mr. Granger and Mr. Wong had their cots on the other side of this improvised wall, but by folding up one of the beds in the day time, their erstwhile dormitory was restored to its proper use as a passageway from bow to stern, except indeed when we blocked it again while gathered there for our meals. The two sailors and our Chinese assistants slept on the floor just beyond the cabin.

All of the forward part of the junk was needed by the crew, consisting of twelve rowers, two steersmen, and the crew's cook. The *laodah*, or captain, had a bunk high up in the extreme stern, but the rest of the men lay down at night on almost the identical spots where they had stood to their labors during the day. They were protected from the elements by pieces of rush matting ingeniously erected on poles in about three minutes after the boat was tied up for the night. We marveled at the contentedness and even joyousness of these men who worked at the oars and sang to the strokes, fed only on meager rations of rice and green vegetables with occasionally a very little pork. Culinary operations by two separate cooks on two sorts of stoves were also conducted on that much overcrowded forward deck.

The Hsin Lung and the Hsin T'an are the only rapids bad enough in the spring season to warrant passengers disembarking. Our junk, being well manned for its size and guided by a special pilot, took the rough water of both of these rapids splendidly. Just below the Hsin T'an is another very short but troublesome rapid. This time two special pilots were hired, one to handle the tiller and one to manipulate the forward sweep, usually in the hands of our captain. At this last place, a steamer was tied up to the shore and her crew was steadily bailing out water. She had come to grief while trying to get up this rapid a short while before.

Assuredly the "god of flowing waters" was ranged on our side throughout this wonderful trip. The only accident we had to report was a broken oar, and this had happened where we could easily stop for repairs. The god of bandits, though, was not quite so mindful of our welfare. At the town of Kuei Cho, where we moored the second night, we were told that we were liable to meet trouble on the morrow. Shortly after

lunch it came. We were then passing through the middle of the inspiring Wu Shan gorge. So great had been my joy at having a chance to see this long gorge—the most interesting of all the gorges—at a slower pace than was possible when we came up in the steamer, that I had completely forgotten the danger that threatened. Not so with the wiser heads of our party. Even as the first shot was fired, Mr. Granger was out on deck conning the cliffs with his field glasses for suspicious figures.

The shot was evidently intended for the man who was up on the running board holding the tiller. Two others followed in quick succession and these were aimed at the two sets of rowers. All three shots fell in the water. By this time everybody who could shoot had grabbed his gun and the return salute commenced. From my position on the floor of the cabin the reverberations sounded tremendous and as I was unable to tell which party was doing the firing, I assumed it must be largely the bandits and was naturally full of alarm. In reality all of the noise had proceeded from the junk, and it proved to be as effective in scaring the bandits as it had been in frightening me. Mr. Wong held the only long-range rifle and he was the first to open fire. Soon one of the sailors (who had taken a prize for good marksmanship) took the weapon from him and he was successful in scattering the straw thatch off a little hut which had evidently been sheltering our assailants. This put the finishing touch to their rout.

That there were no more than five men seen by our party was no guarantee that a larger force was not in hiding. We reckoned that they had the surprise of their lives when so great a racket came forth suddenly from so peaceful-looking a junk. The bandits were armed (Mr. Wong tells me) with high-power modern army rifles, whereas our complete outfit consisted of only two No. 12 shot guns, one 25-caliber Savage sporting rifle, four automatic pistols (including the two carried by the sailors) and a small, short range, combination 22- and 44-caliber gun.

Twenty-five li (about eight miles) below this point of attack was another place with a bad reputation for robbers and here Chi and Buckshot prepared to have some fun at Chow's expense by making him stand up with the little combination gun. He and the Chinese soldier passenger had flattened themselves on the floor beside me during the actual engagement at P'ai Shih and that had not accorded with their ideas of valor. Fortunately the rest of the afternoon had nothing further in store for us of a militant nature but the uncertainty as to what might happen kept us all watchful. Darkness had long since fallen when we reached a place where it was considered safe to tie up for the night.

If anyone should ask us whether we can recommend a similar jaunt down this age-old river when peach and plum blossoms deck the banks and spring adds a deeper hush to the silence of the gorges, we should have no hesitancy in saying, as the Chinese phrase goes, *k'o i* (can do), but should the question be as to whether we wish to renew experience with Chinese bandits, the reply would be emphatically, *pu yao* (not want).

# Aiming a Camera at a Wild Mountain Goat[1]

By WILLIAM T. SHAW
Professor of Zoölogy, State College of Washington

ONE object dominates the landscape east of Bellingham Bay, Washington. This is Mount Baker, sun-bathed and radiant in the glory of its oneness. Beyond, standing scarcely a score of miles away, is Shuksan, all but hidden and little known, slightly less in altitude,—in ruggedness and inaccessibility quite the equal of the greater dome. Between, lies Austin Pass, of such remoteness as to challenge the visits of mountain-loving men from far up and down the Pacific Coast. Here, protected in its Arctic fastness, the slowly diminishing species of wild mountain goat in western America is making one of its last stands.

Biological research had taken me into this region during mid-August of 1922. At first my camp was solitary. Then, one evening a troupe of pack-laden boys came in "to do the peaks" and after they had enjoyed a brief space of rest and a cup of steaming coffee, we were "pards" in the fortunes of the forests and friends for life.

One morning soon after their arrival, one of their number, Mr. Henry Howard, Scout chief at Bellingham, and I dropped over the Pass down into one of the headwater forks of the Swift. We carried with us an outfit of traps and photographic material. After an hour or two of investigation in the grass meadows of the Swift, we left the trail and headed straight up for Crater Mountain, where we hoped to arrive in time for a certain afternoon lighting on the great ice dome of Baker.

Dropping down a thousand feet and climbing back over a trailless slope of moss, brush, and sliding granite flakes, is an endurance-testing feat; so when pockets were turned out and found to produce only one English walnut and two peanuts—last remnants of trap-line bait—as the day's meal for two toiling men, we had to look the problem squarely in the face but decided nevertheless to continue our journey upward. At last the old crater ridge was reached, and the tripod planted squarely in fine view of Baker, but just as the focusing was finished, my companion said, "Goat!"

Yes, it was a goat, a big wild mountain goat, wary and unhampered, with no park affinities to dull his instincts or lessen his aversion for man. There he stood, squarely in the field of the binoculars, quietly grazing from a patch of snow grass growing on the cañon-side, though quite a mountain mile from us.

Goats,—well did you ever try to photograph one?

To back up endurance a walnut and any number of peanuts are no fit substitutes for bacon; yet down came the tripod, and soon we were under the packs once more. By this time the goat had apparently finished his pasturing and had taken on some degree of stability,—just what we could not determine from our distance. At least he was not moving away.

We went along as quietly as possible on the lower side of the ridge, walking on the sun-softened snow whenever it

[1] In popular parlance this animal is referred to as a goat, but from a scientific standpoint this is not an accurate designation, for this ungulate is a member of a group more or less intermediate between the typical goats and the true antelopes. Like the American robin, which is not a robin but a thrush, the Rocky Mountain goat is the victim of a popular misconception.

*Photograph by William T. Shaw*

**SHUKSAN FROM CRATER MOUNTAIN**

The rugged beauty of Shuksan, a close rival in height of the more celebrated Mount Baker, is seen to advantage from this point of observation

point of observation

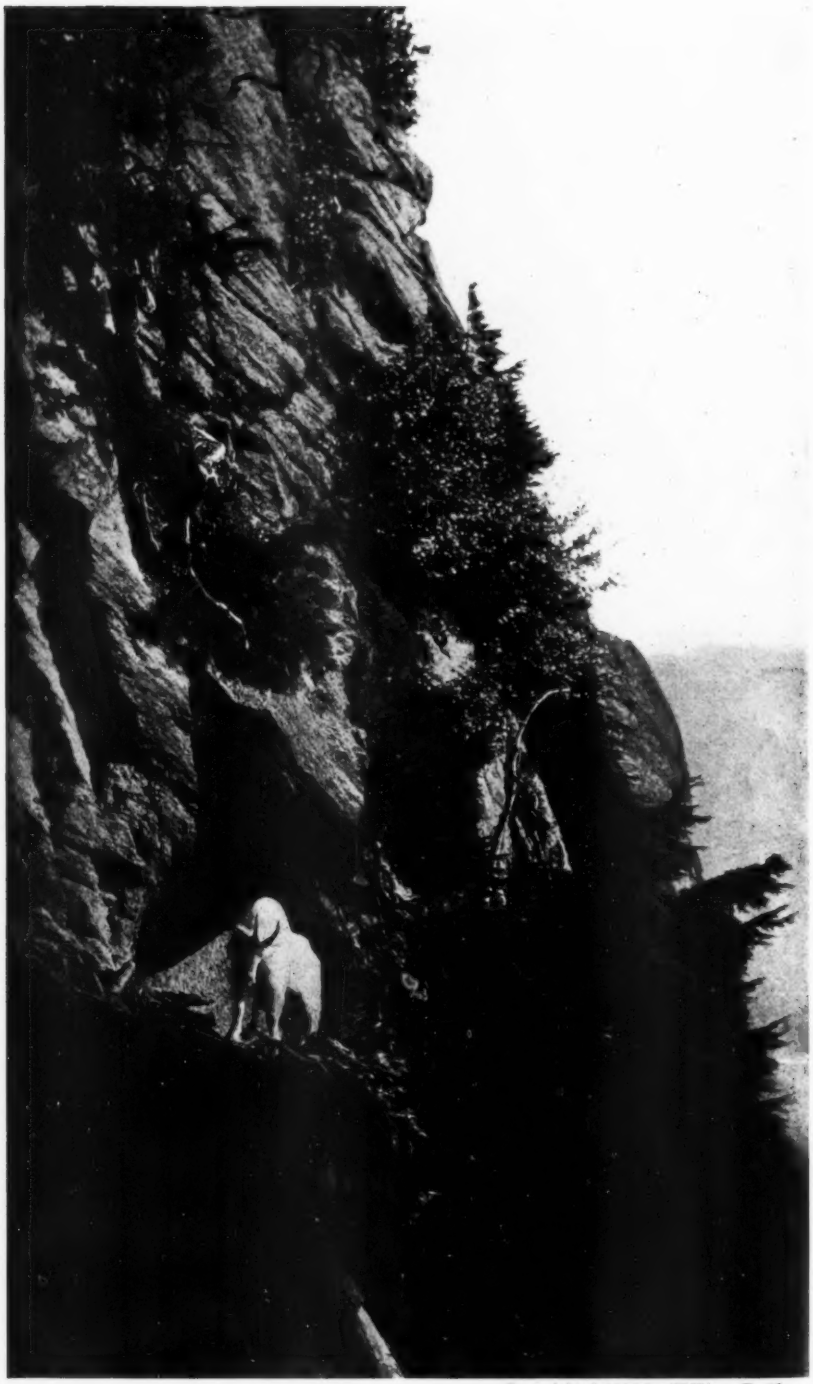
382

*Photograph by William T. Shaw*

SHUKSAN FROM AUSTIN PASS

The aspiring height of Shuksan gains in impressiveness when seen mirrored in the still waters of a lake

383



*Copyrighted 1923 by William T. Shaw*

CONFRONTING THE INTRUDER

This picture gives an excellent idea of the habitat of the animal: the great height of the cliff, the depth of the cañon, and the mountain landscape in the background. The animal stands as if in a shadow box produced by the niche in the rock. Its sturdy mountain-climbing limbs are firmly placed, and the body form, massive shoulders, and head are well indicated by quartering light

led in the direction in which we were tending, grateful always for the gentle breeze fanning full in our faces. When the distance was about half covered, we parted, and Henry dropped down through the timber to reconnoiter, while I kept to the up-running ridge, hoping to get above the goat,—a principle the value of which is well known to hunters of these animals. Passing a little grove of high-mountain hemlock, my attention was attracted to a well-marked trail leading out along the bluffside. Within this clump of trees was a veritable lair, where the goat had undoubtedly spent many a warm summer afternoon. Going back, I awaited my partner, who soon came up, reporting no sign of the goat, but expressing the belief that the animal was somewhere beyond a second or third prominence of rock reaching out from the main bluffside.

I showed him the trail, but no need—the incident of the walnut had long since been forgotten. We were after goats now! Slowly and cautiously we crept out along this path, and I still remember distinctly the pertinent things that passed keenly through my mind as we went carefully along. Here was vegetation such as had been found along a deserted goat trail on Rainier two years before. This was goat country to be sure. There were the patches of snow with lush grass of tempting greenness such as goats would drop low to procure. Far below we looked into the cañon of the Swift.

Out and out we went, as cautiously and silently as is possible on a granite-chipped goat trail. At one point we left a pack sack, at another a tripod or trapping bag,—whatever would lighten our burdens. Finally we passsed the second of the outstanding faces, with still a hundred yards to go. Have you ever noticed how hobnails grate against a slanting floor of granite? We were keenly aware of it, and presently discarded the shoes that bore the nails. With careful step we approached the last outstanding face, now creeping along the trail, again flattening against a difficult corner of jutting rock, listening to our own heartbeats, as a dislodged pebble went clattering down the cañon-side, expecting to hear at any moment a greater clattering of pebbles, loosened by a justly suspicious and alarmed goat. But the expected did not happen, and I shall never forget the expression on Henry's face as he turned around to me after looking over the ledge, saying in a whisper, "There's your goat." And there, in a beautiful coat of snowy hair, glistening in the sun of a late afternoon, lay the dozing animal, on the flat upturned stump of a tree that had been storm-wrenched from the mountain-side. He was probably not more than twenty-five or thirty feet away.

The sun was warm enough to produce marked respiratory movements over his flanks. His expression,—well it was that of boredom, as with half-closed eyes, and wearily twitching ears, he occasionally swung his head slowly in evasion of a large fly that buzzed about him.

Just one satisfying peep and we began work on the camera, a five by seven, fitted with a Zeiss Tessar lens, Series IIb. Moments were moments now, for what if the fickle wind of a mountain cañon should suddenly change? Fortunately there was a flat rock just man-high in front of us. Beyond was an open space past which we could not go. Here was our last stand. Cautiously we slid the camera up on the rock and with equal care leveled it with bits of flat stone flakes.

*Photograph by William T. Shaw*

MOUNTAIN HEMLOCK

This locality is within a short distance of the region where the picture of the mountain goat was obtained. The photograph was taken from Crater Mountain, looking northwest across the valley of the Nooksak to the Church Mountains. Two splendid examples of the mountain hemlock occupy the foreground. This tree is usually found in high altitudes, not infrequently growing in exposed places

The finding cloth was worked over with scarcely an inch to spare, the chief anxiety being to place the goat well in the middle of the field and to secure a careful focus.

Only two plates remained from the day's work. One of these was at once exposed. The other, a postcard size in a kit was the next and last. Again focus and other adjustments were gone through and every precaution taken to make the best of the situation on this greatly narrowed field and one remaining plate. We were ready, but why make a duplicate exposure? In whispered consultation we talked it over and decided to take a risk. Cautiously I began showing myself above the rock. At first the goat paid no attention, but in a few moments he began to look my way and then, half-suspicious, he gazed at me with a keen steady stare from his clear black eyes. I made no sudden movement and he was not alarmed; yet, still eyeing me, he got up and after a moment silently drew his body into one great muscle-straightening stretch. What a huge creature he was! Without moving from his tracks he looked calmly about, up and down and far out over the cañon. Slowly his head swung around and, as I saw the sharp tips of his beautiful black horns stand out vividly against his massive white shoulders, something told me the psychological moment had come and I pressed the bulb.

Just two hours before, we had been somewhat indifferently viewing this animal with the binoculars from Crater Mountain.

SEQUEL.—Not far back along the goat trail lay an object we had not discarded,—a gun, with ammunition of sufficient power to have served our needs. Over in camp was a State paper giving us the privilege of collecting for scientific purposes. Again we held a council of war,—yet was it not a parley of peace?

Three thousand feet below, from the little silver thread of the Swift, came the peaceful murmur of running waters. Far over the intervening weathered cañons lay silent Baker, flooding our wall with a warmth of reflected light and heat, shared by all alike, in that lovely, closing, summer day. Over to the east stood Shuksan, calm and patient in its vigil, a vigil maintained through countless ages. Our council *was* a council of peace.

*Courtesy of Mr. Watts, Utah Fuel Company*

A track imprint in the roof of a coal mine; the spread between the toes is twenty-four inches

# Dinosaur Tracks in the Roofs of Coal Mines

## A STRANGE PHENOMENON NOTED IN UTAH AND COLORADO

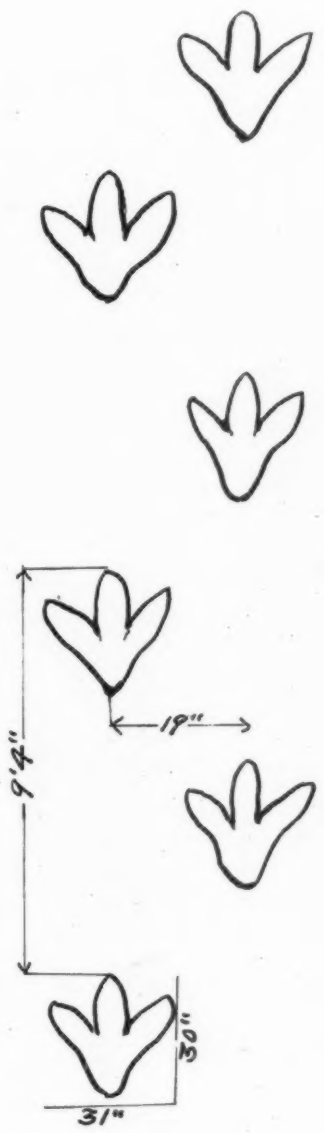
By WILLIAM PETERSON

Director and Geologist, Agricultural Experiment Station, Utah Agricultural College, Logan, Utah

TO view the tracks of ancient Cretaceous monsters is not an entirely new experience, but to view these tracks from beneath instead of from above is somewhat of a novelty. This is a privilege open to those interested in the ancient life of the Cretaceous seas of Utah and Colorado. It was the writer's good fortune to spend three summers in a detailed survey and inspection of the coal deposits of Utah. While he was examining the underground workings of many of the mines, attention was called to certain protuberances from the coal seam roof. A definite shape had been recognized in the case of some of these, though most of them were spoken of as "carbuncles," "nigger heads," and under similar terms. In areas where the coal was low these protuberances had to be removed to give room for the mine hauling, for

some of them projected as much as a foot below the roof of the coal seam. In some places the projections appear in groups while in others they are solitary.

After inspecting hundreds of these protuberances, the writer agrees with some of the mine foremen and superintendents that these peculiar formations undoubtedly had their origin as tracks of ancient monsters which tramped through or around the border of the Cretaceous sea. The tracks seem to have been made at a time when the peat accumulation was covered with a foot or more of mud. The layer of mud was not sufficiently thick to support the weight of the animal walking over it. The feet sank through the mud several inches, or even more than a foot at times, into the soft, yielding peat underneath. Some mud was pushed into the peat as the animal brought down its weight, and as it drew out its foot, the footprint would be filled with mud from above. As time went on, nature's distillation reduced the peat to coal, and the mud with its track projections was converted into solid rock. In most places the coal is easily separated from the roof, leaving the track-shaped protuberance extending partially or wholly as a definite appendage from the ceiling. When the coal is completely removed, the tracks appear in various forms. In some cases the footprints project only part way through the roof and in others they project so far that a clear space is shown between the portion of the track represented by the toes and the solid roof. It is interesting to note that, as far as observed, the largest tracks are the ones which protrude farthest from the rock roof. The material filling the track varies slightly but is for the most part an arenaceous shale or argillaceous sandstone.




Consecutive tracks in the roof of the old Ballard Mine on the property of the American Fuel Company

The animals seem to have walked for the most part along trails or definite paths. It was noted that some of these paths are twenty or thirty feet in width, and the exposures in many entries and rooms of the coal mines show them to be comparatively straight

in alignment. The individual tracks in the paths are seldom clearly outlined and only when one of the animals has traveled independently does every imprint become distinct. In several places it has happened that an entry of the coal mine has followed approximately the path of a single animal, thus exposing several of the tracks for measurement and comparison. Seven consecutive tracks are shown in the old Ballard Mine on the property of the American Fuel Company, located on the Denver and Rio Grande Railroad about eight miles north of Thompson Springs. These tracks are among the largest observed and the measurements are shown in the diagram on p. 389.

In a different entry of the mine, tracks of similar size are found, and by courtesy of the company one of these was taken down and shipped to the Geology Museum of the Utah Agricultural College at Logan. On this page is shown a photograph of this track

The 12-inch rule, laid on this track after it had been removed from the roof of the old Ballard mine, indicates the huge size of the track

with a 12-inch rule placed on it for comparison. The track measures 31 inches between the spread of the outer toes and 32 inches from the heel to the front of the middle toe. Near the point of separation the toes are from 6 to 8 inches in diameter, and the toes are so pointed as to indicate the presence of rather sharp claws on the end of each toe.

In the mine at Castle Gate, Utah, a photograph was taken of one of the tracks as it appeared in the roof of the mine before removal. The photograph (see p. 388) is furnished by courtesy of Mr. Watts of the Utah Fuel Company. This track, which is similar in character to those mentioned above, is somewhat smaller than they, being only 24 inches between the spread of the toes and extending for about the same distance if measured from the heel to the front of the middle toe. Only one track smaller than this has been measured, that in the mine at Standardville in Spring Cañon, the length of which is only 16 inches; however, it is similar in other respects to the Castle Gate track. Two casts of tracks have recently been obtained by workmen of the United States Fuel Company at the Panther Mine.[1]

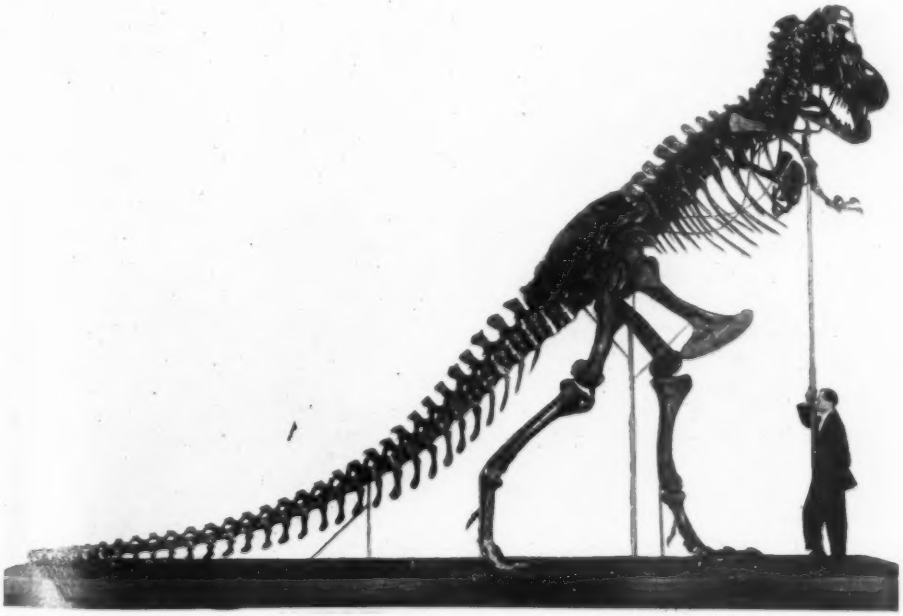
The tracks referred to in this article have been observed by the writer at intervals over an area more than one hundred miles in extent and in different seams of coal, which represent a stratigraphic thickness of more than two hundred feet of sandstone including three or four beds of coal. The coal seams total in thickness approximately thirty-five feet. The deposit is near the base of the Mesa Verde formation of the Upper Cretaceous. The tracks are all of the three-toed type

[1]There are unauthenticated reports that similar tracks have been observed on the roof of the coal mine at Somerset, Colorado.

and seem to have been made by an animal that walked only on its hind feet. In one place, where the roof of the mine was badly caved, careful examination was made for any trace of either front feet or tail track, but no evidence of either was found.

The most startling thing about the tracks is their enormous size. The writer has examined painstakingly the feet of the mounted skeletons of the *Apatosaurus*, *Ceratosaurus*, *Claosaurus*, *Hadrosaurus*, and others, but none apparently have feet large enough to fit these tracks.

Dr. W. D. Matthew of the American Museum interprets the tracks as having been made by a member of the deinodont family of dinosaurs, of which the *Tyrannosaurus* is the largest known type. He further describes the *Tyrannosaurus* as "the climax of evolution of the giant flesh-eating dinosaurs. It reached a length of 47 feet and in bulk must have equalled the mammoth, mastodon, or the largest living elephants. The massive hind limbs, supporting the whole weight of the body, exceeded the limbs of the great proboscideans in bulk, and in a standing position the animal was from 18 to 20 feet high as against 11 feet or so for the largest African elephant or the southern mammoth. The head was 4 feet, 3 inches long; 3 feet, 4 inches deep; and 2 feet, 9 inches wide. The long deep powerful jaws are armed with teeth from 3 to 6 inches long." The front limbs were small and were probably used only in capturing and gathering food. The great bulk of the body would imply slow movement, and that food was obtained from the shallow water of the Late Cretaceous sea.



The skeleton of *Tryannosaurus* in the American Museum

# Dean's "Bibliography of Fishes"
## A Review

By RAYMOND C. OSBURN
Professor of Zoölogy, Ohio State University

A BIBLIOGRAPHY is usually considered the driest and most uninteresting matter that can be reduced to print. The subject of the present review is much more than the usual catalogue of scientific writings in a particular field, for its completeness and manner of treatment lift it entirely out of the category of ordinary bibliographies and make it an outstanding contribution, not only to the subject of ichthyology in its various phases, but to every field of work connected with the lower vertebrates.

The prefatory remarks by Dean in this Bibliography indicate that he and his collaborators have taken this work very seriously and that the almost limitless task has often appalled them, as well it might. The quotation from Wood's preface to his *History of Oxford*, given in Dean's preface to Volume III, is certainly well chosen:

"A painful work it is I'll assure you, and more than difficult, wherein that toyle hath been taken, as no man thinketh so no man believeth, but he that hath made the triall."

The fishes occupy a unique position in zoölogical work, for they are the fundamental group among the vertebrates and must be investigated with regard to the evolution of every important anatomical, embryological, and physiological character shown by their higher relatives, and of all the vertebrates, with the exception of our domestic animals, they have the most important economic relation to man. Approximately 45,000 titles are included in Dean's Bibliography, the dates of publication extending from the time of Aristotle to the present, and this list does not include the vast amount of literature on marketing or utilization unless the papers are of special interest.

The Bibliography is a stupendous affair in three volumes, totaling 2127 pages,—a truly astonishing compilation of the sources of information, but so well arranged and digested that it affords easy access to the mine of knowledge regarding this group of animals.

The Authors' List of signed publications, since the period of Linnæus, occupies all of Volume I (published in 1916) and nearly all of Volume II (1917) and this, with the Addenda of 199 pages in Volume III (1923), makes an authors' catalogue of 1693 pages, covering the titles since the publication of Linnæus' tenth edition of *Systema Naturæ* in 1758. At the end of Volume II and the beginning of Volume III is a list of Anonymous Works, covering 29 pages. Volume III also contains a list of Titles of Pre-Linnæan Publications, totaling 134 pages; a list of the General Bibliographies Referring to Fishes, 4 pages; Voyages and Expeditions Which Relate to Fishes, 5 pages; Periodicals Relating to Fish and Fish Culture, 6 pages; Errata and Corrigenda, dealing chiefly with the correction of the names of foreign writers and with duplication in reprints, 7 pages. This is followed by a Subject Index of 305 pages and a Finding Index of 40 pages.

In the general Bibliography explanatory notes are inserted frequently under the titles. For example under Mast, S.O., "Vision in Flounders" is the following: "Simulation of background regulated by visual stimuli. Evidence of color vision. Motion vision as acute as in man." After Okada, S., "Catalog of vertebrated animals of Japan," is the note, "Classification in Latin; species in Latin and Japanese." The Authors' List is thus rendered much more useful than would be the case if there were merely citation of the titles and place of publication as in ordinary bibliographies.

In the section of Pre-Linnæan Publications these notes are more numerous. For example, under Leeuwenhoek, Antony van: "Continuatio arcanorum naturæ detectorum," Delft, 1697, the note, "Sexes of eels, circulation in eels, and scales of fishes." Under Marcgrave, George, (1610–1644), are given the various ways of spelling his name and references to biographical notes concerning his life and work, and under the first of his titles,—"Brasilianische Naturgegenstände

(Collectio rerum naturalium Brasiliæ) c. 1643," "these water-color drawings of the animals and plants of Brazil, made by Marcgrave, are preserved in the great library of Berlin, labeled 'Libri Picturati A. 36–37.' There is reason to believe that Count Maurice of Nassau-Siegen made some of these paintings. On at least some of the figures of fishes there are notes in his handwriting. They are (in part) the originals of the figures in Marcgrave's great work."

These copious notes on Pre-Linnæan works, including historical items, biographical notes, brief digests of the contents of papers, later editions and translations, etc., are sufficiently useful and important to justify the space occupied by and the care and labor expended on this study of the ancient literature devoted to fishes.

The Subject Index is naturally of the greatest interest and importance, not only to ichthyologists, but to students of vertebrate zoölogy, anatomy, embryology, parasitology, ecology, physiology, and teratology. The fish culturist, the angler, and the general reader will find a guide to special topics in this index. A careful analysis of the literature dealing with every subject pertaining to the life, structure, development, and habits of fishes is here made; the various theories of development, phylogeny, etc., that have been proposed are outlined, and the most important papers indicated by a star. The amount of material that has been digested for this purpose is not the least of the astonishing features of this unusual Bibliography.

The treatment of the Subject Index leaves little, if anything, to be desired. As examples of the arrangement, the discussion of behavior, habits, and angling will serve as well as any.

"Behavior," comprising the comparative psychology of fishes, covers about two pages, with cross references to other headings, such as: reactions to chemical stimuli, hearing, commensalism, and parental care. There is a paragraph containing general references to works on animal psychology, and following that appears the special literature, grouped under such sub-headings as the following: accounts or narratives depicting unusual actions or behavior; behavior of various types, chiefly instinctive; color perception; intelligence; memory; and the effects of stimulation by electricity, gravity, light, touch, and water currents. In fact, the materials are so assorted that one may readily find a reference covering almost any question that might be asked as to fish behavior.

Under the topic "Habits of Fishes" (covering nearly two pages), besides the usual cross references and general references, we find the papers dealing with habits classified under the natural order to which the fish belongs. For example, the papers devoted to the habits of the various sharks are brought together, and similarly those pertaining to the eels, the perches, etc. Other sub-headings are: various specific habits, such as burrowing, fighting, inflation, and water throwing.

Further references are also given at the proper place in the catalogue to such topics as sleeping habits, resting habits, nest-making, care of eggs and young, and all of the thousand and one things that the general reader, as well as the ichthyologist, may wish to know about the habits and mode of life of various fishes.

"Angling" embraces general treatises, in Dutch, English, French, and German, and bibliographies and catalogues of angling literature; historical matter, subdivided into Pre-Linnæan treatises, general treatises, books on husbandry, early laws pertaining to angling, dictionaries and encyclopedias, guides, handbooks, etc., piscatory eclogues; fly-fishing; sea-fishing; angling for salmon and trout; angling for various fishes; angling classified by regions—North America, Europe, and other localities. Here is sufficient material to point the way to the student of angling from the historical or any modern phase.

To the Systematic Section of the Subject Index is given the same scrupulous care as to the other sections, often with special reference to particular species that are of the greatest interest, though in general no attempt is made to index farther than genera,—and, in fact, another series of volumes would be required if such references were to be included. As examples of the treatment of the systematic portion we may call attention to the subheads under the Salmonidæ and Anguillidæ.

"Family Salmonidæ" (six pages); distribution, embryology, fossil forms, taxonomy; subfamily Salmoninæ, American trouts, European trouts, Atlantic salmon, references to American forms, references to European forms, general treatises, growth, metabolism during sojourn in fresh water, feeding, migrations, reproduction; Pacific salmons, general, death after spawning, growth and reproduction, migrations; *Salvelinus*, Ameri-

can forms, European forms; miscellaneous papers on salmon and trout, in various languages—Danish, Norwegian, Dutch, English, French, German, Hungarian, Japanese, Latin, Russian, and Swedish. And so on through the other subfamilies of the Salmonidæ.

The eels ("Family Anguillidæ") are given somewhat different treatment, as follows: principal literature; life history of the eel (more than a page devoted to outlining the history and indicating the literature of this phase of the subject); sexes of the eel; various leptocephali; general literature; taxonomy; other genera of the Anguillidæ.

The Finding Index is merely an index to the Morphological and Systematic Sections of the Subject Index and refers therefore only to part VIII, or pp. 361–665 of Volume III. Naturally it is a very useful portion of the work. Dependent upon the Authors' List alone, one would have to know the name of the author before locating a particular title: even with the addition of the Subject Index, one might have to look for a long time before finding all references to a particular topic—such, for example, as "Fins." In the Finding Index one is referred to the page in the Subject Index where the topic is mentioned, and the most important of such references are in boldfaced type. Under "Fins" seventy-four such references are found, and these are arranged for convenience in twenty-four groups, such as: paired fins, vertical fins, locomotion by, abnormal, primitive, etc.

If the student of fossil fishes wished to look up Dean's work on *Cladoselache*, he might turn to the Authors' List in Volume I, where he would have to scan nearly five pages of titles by Dean—and titles unfortunately do not always indicate all the contents of papers. If he knew the systematic position of *Cladoselache*, he might turn to the proper place in the Systematic Section of the Subject Index, where under the "Order Pleuropterygii" he would find Dean's three papers on this genus given in such form that he could locate them in the Authors' List without delay. If he turned at once to the Finding Index, he would come upon page references not only to the Systematic Section, but to three other references in the Morphological Section, where special points in the structure of *Cladoselache* are mentioned. Though this may at first seem a little complicated, anyone with experience in tracing out the literature of a subject will realize at once that only in this way could the vast and varied literature on the fishes be made available.

No one would expect such an extensive compilation to be absolutely perfect,—the authors least of all would make such a claim. Yet the reviewer has run down many subjects, in which he may claim to have some knowledge, without finding any serious errors. It is in cross-referencing, naturally, that such slips are likely to occur. For example, in the Finding Index one finds "*Batrachus*, see *Opsanus*," but under *Opsanus*, where the page references are given to both *Batrachus* and *Opsanus*, there is no indication that these terms are equivalent. Also there is a reference to *Opsanus*, p. 410, but on turning to this page no reference to either *Opsanus* or *Batrachus* can be found. Under "Fins" in the Subject Index one is further referred to "Limbs." This heading does not appear in the Subject Index, and upon turning to it in the Finding Index one is again referred to "Fins," where all references are given. Guided by the Subject Index the reviewer has followed up in the Authors' List the references to the papers of various writers with whose work he is familiar, but has failed to locate any errors.

In the prefaces to Volumes I and III are explained the origin, purpose, and methods pursued in the compilation of this great work, and credit is given to those who have rendered assistance. The most prominent among these are Doctors Louis Hussakof, Charles R. Eastman, Eugene W. Gudger, and Mr. Arthur W. Henn. The debt of science to Professor Dean and his collaborators is great indeed, and acknowledgments would not be complete without reference to the broad-minded policy of President Henry Fairfield Osborn and the Board of Trustees of the American Museum in providing funds to finance the publication and to pay the salaries of the editoral staff.

A résumé of this work would be incomplete without special reference to the work of Dr. E. W. Gudger, editor of Volume III, and the associate bibliographer, Mr. A. W. Henn. The tremendous task of bringing together the Subject Index of 274 pages might have been sufficient to deter even the most experienced from undertaking it. But no mere technical bibliographer could have succeeded with this phase of the work. It required the expert knowledge which only a well-trained zoölogist, thoroughly familiar with the fishes, could

bring to the performance of the task, which required not only a careful indexing, but a full appreciation of the contents of the papers listed in the authors' catalogue. That the task has been admirably done no one will gainsay, and this portion of the work will stand as a lasting monument to the service which these scientists have rendered in the field of ichthyology.

In closing, the reviewer cannot do better than to quote the final paragraph of Dean's preface to Volume III, "The present volume terminates a task, infinitely painstaking, thankless, insistent, withal necessary, which has been upon our table for over thirty years. It seemed never to end, and we grew old with it; *Quousque tandem!* Our hope is only that the references we now provide will be of constant service to workers everywhere, for when all is said and done, an elaborate bibliography is the strongest scaffolding upon which any research can be built." The only exception one may take to this is in regard to the thanklessness of the task. In this we cannot agree with Professor Dean, for we feel sure that countless workers will have occasion to heap silent gratitude upon him and his staff of collaborators for generations to come. Such a landmark in vertebrate zoölogy will hardly cease to be useful until science in this field has progressed far beyond even our present conception of its possibilities.

# A Historical Sketch

By E. W. GUDGER
Editor of Volume III

IN 1890, Dr. Bashford Dean, then instructor in zoölogy at Columbia University, began his career as the leading American student of the anatomy, embryology, and palæontology of fishes.

In exchange for papers from his prolific pen, articles on fishes came from students of ichthyology all the world over. From these and from the bibliographical lists of papers cited in his own publications, he began to build up for the use of himself and his students a card catalogue which formed the nucleus of the present *Bibliography of Fishes*.

In 1895, Doctor Dean published his well-known book *Fishes, Living and Fossil*. In this was a twenty-page bibliography of the embryology, morphology, and palæontology of fishes, composed of the most important citations found in his card catalogue. Notwithstanding the fact that these references were put in the most abbreviated form possible, this bibliography was often referred to in ichthyological articles during the next twenty years.

In 1903, Doctor Dean was made professor of vertebrate zoölogy in Columbia University, and in 1907 curator of fossil fishes in the American Museum. Two years later (1909) he became curator of ichthyology and herpetology in the Museum. In the meantime the roster of his publications on both fossil and recent fishes grew as did his card catalogue. By 1900 this catalogue contained about 20,000 entries, and was by far the most extensive catalogue of ichthyological literature in existence.

Doctor Dean's students made free use of it and added citations of their own where any were found lacking. Correspondents wrote in for lists and in turn sent in lists of their own, and students of ichthyology even came to New York to consult the entries. By 1910, this card bibliography, which in the meantime had been removed to the American Museum, had reached a critical stage in its development, for it had become too immense to be carried on by one man, upon whose time and energies multifarious duties made demands. It was also clear that it had become a great reservoir of references which ought to be made accessible to workers not merely in America but all over the world. To achieve this end it would have to be published.

It was clear, however, that in the form in which its entries were set, it could not be put into print. The material required revision and additions. It was imperative that the earlier bibliographies—those of Agassiz, Bosgoed, Carus and Engelmann—be checked up. The cards of the *Concilium Bibliographicum*, and the entries in the *Zoölogical Record*, the *Royal Society Catalogue*, and other recent bibliographies would have to be examined critically. Then in many cases citations would have to be compared with the original titles in order to clear up discrepancies, and

bibliographies in special outstanding books and articles would have to be reviewed. Finally, it would be necessary to ask specialists in ichthyological subjects all over the globe to send in lists of their publications. All this in order that nothing might be omitted, that this work might be truly a BIBLIOGRAPHY. But how was all this to be done?

Then the man and the opportunity met. President Henry Fairfield Osborn, with a great vision of what might be done for science in general and for ichthyology in particular, brought the resources of the American Museum to the aid of this great enterprise, and funds were made available to provide a secretary for the work of checking up, verifying, and transcribing references. Later, when publication began, certain friends of the enterprise, particularly Mrs. Isaac M. Dyckman, Mrs. Bashford Dean, and Doctor Dean himself, generously contributed funds.

About 1910, Doctor Dean, being occupied with many other matters, entrusted the responsibility of supervising the work of the secretary, Miss Evelyn Tripp, to Dr. Louis Hussakof, associate curator in the department. During the next five years the scientific literature of the world was minutely searched for ichthyological titles. The largest single contribution was made by the Smithsonian Institution, which turned over to Doctor Dean the huge manuscript bibliography collected and compiled by the late Dr. G. Brown Goode, who for many years before his death had been engaged in working up a fish bibliography along similar lines. In the meantime letters had been sent to 468 leading specialists the world over, asking them to send in titles of all their papers dealing with fishes. Of this number 304 complied with the request, and thus a vast amount of data came at first hand to the Bibliography.

In 1914, Doctor Dean, who had previously been made curator of arms and armor in the Metropolitan Museum of Art, felt obliged to retire from the headship of the department of fishes in the American Museum, and became its honorary curator. Doctor Hussakof was promoted to curator, and because of his increased duties as head, was obliged to give up the supervision of the Bibliography. About this time Miss Tripp resigned and was succeeded by Miss Marguerite Engler, who served as secretary during 1915–16.

At this critical period in its history, the Bibliography was certainly favored by fortune. Dr. Charles Rochester Eastman, the distinguished student of palæontology, having just finished certain special researches on the fossil fishes in the Carnegie Museum, Pittsburgh, was persuaded to assume the editorship. Not only was Doctor Eastman a distinguished palæontologist, but he was almost equally well known as a palæobibliographer—having a knowledge of the Pre-Linnæan literature of fishes probably unequalled in America—all this due to his researches not only in ancient fishes but also in the older literature of this subject. His wide experience as a student of fishes, his extraordinary linguistic attainments, his natural critical faculty, and his ability to do an enormous amount of work made him an ideal editor for the *Bibliography of Fishes*.

Under Doctor Eastman's hand there went steadily forward the enormously detailed work of compiling and editing into definite and uniform style the 37,000 titles found in Volumes I and II. No one who has not had the experience can realize the prodigious task involved in such editorial work. A uniform style had to be decided upon for titles; capitalization, spelling, abbreviations, punctuation, and styles of type had to be standardized. And when these standards had been established, the task of editing the myriads of cards according to these standards was truly Brobdingnagian. But Doctor Eastman was not to be discouraged, and when Volume I appeared in the spring of 1916, it is not putting it too strongly to say that it created a sensation among American men of science, and particularly among students of fishes. This volume embraces the letters A–K and covers 720 pages.

In 1916, Miss Engler retired from the position of secretary and her place was taken by Miss Florence Schwarzwaelder, who devotedly served the Bibliography until the summer of 1919. Also late in October, 1916, Mr. Arthur W. Henn, at that time a graduate student in zoölogy at Columbia University, began half-time work on the task of noting on the proof sheets alongside each citation the entries for the Subject Index.

Doctor Eastman having brought Volume II, comprising the letters M–Z, plus the Anonymous Titles—a total of 702 pages—through the press in 1917, sailed about June 1 for Brazil to collect fossil fishes, having at the same time, however, a connection with the intelligence branch of the United States gov-

ernment. Doctor Dean had entered government service as major in the ordnance division, where his special knowledge of armor was of the greatest service. However, Mr. Henn and Miss Schwarzwaelder went on with the work of indexing. The present writer having expressed his warm appreciation of the great value of Volume I of the Bibliography, and having sent in a good many missing titles, was invited to come up and hunt for others, and at this task he spent the months of June and July, 1917.

The summer of 1918 brought Doctor Eastman back from Brazil, but he at once "joined up" with the War Trade Board in Washington. Doctor Dean was up to his eyes in the work of making invaluable improvements in helmets and gas masks for the ordnance division of the War Department. During the winter and spring Mr. Henn continued to work on the Subject Index, but in April went to France with the American Expeditionary Forces. I had devoted much time during the winter to the collecting of missing titles, and toward the close of May I again came to the Museum, bringing 1400 titles with me and spent the months of June and July in this work. Then in September Doctor Eastman, who during the war had been subjected to at times dangerous and always nerve-exhausting duties, was drowned at Long Beach. In consequence of all these things, work on the Bibliography was almost at a standstill during the winter of 1918–19.

It was at this stage in the history of the enterprise that Doctor Dean sent in the following quotations for ultimate setting on the page immediately preceding the preface of Volume III.

"Deep calleth unto deep at the noise of thy waterspouts; all thy waves and thy billows are gone over me."—Psalm XLII.

"Tetzel, the Bohemian, gazing at the sea at Cape Finisterre, remarked—as if he had our Bibliography in his mind's eye—'The end of it no one knoweth, save God alone!'" *The Bohemian Ulysses* (1477); Mrs. Henry Cust, *Gentleman Errant*, 1907, p. 87.

On June 1, 1919, I came up from the North Carolina College at Greensboro, under promise to Doctor Dean to stay with the Bibliography as editor until it was finished. A few weeks later Mr. Henn returned from France, was discharged from service, and began on a full-time basis the work of finishing the index notations. In August Miss Francesca La Monte assumed the duties of secretary, and the work of completing Volume III went forward under a full head of steam.

At this point it was decided on the urgent advice of Doctor Dean to limit titles in our Addenda to the close of the year 1914, which marks a great break in scientific work and literature due to the World War. In Volumes I and II Doctor Eastman had included titles of works that appeared later than 1914, with the idea that the Addenda should bring the literature up to the time of going to press with Volume III. That Doctor Dean's judgment was sound, and that it saved us a world of trouble, has since been realized a thousand times by everyone concerned. In two sets of cases only have we violated this rule. There have been included *all* the papers of Eastman, Steindachner, and others who have died since 1914, so that their lists might be complete; and in the second place such outstanding epoch-making works as Boulenger's *Freshwater Fishes of Africa* and Jordan's *Genera of Fishes* have been listed. For the same reason we have set in the Subject Index such authoritative works as Radcliffe's *Fishing from the Earliest Times* (1922), Phisalix's *Animaux Venimeux et Venins* (1922), and others of like standing, because these review the literature extensively and are literally the last word on the subjects considered. This was done even though these titles came to us too late to be included in the Addenda.

When I came to the Museum from Greensboro in 1919 with a year's leave of absence, we all thought that the Bibliography could be finished in fifteen or eighteen months, but in the spring of 1920, it became clear that at least two years more would be needed for the task. In the meantime (spring of 1920) the college authorities in North Carolina were pressing me for a declaration of my plans. Matters were complicated by the fact that Doctor Dean was in Constantinople and President Osborn in Honolulu. However, the task had to be finished, so I sent in my resignation to the college and continued work on the Bibliography.

During the winter of 1919–20 I checked up about 50,000 pages of new and hitherto untouched bibliographic sources, especially in the Pre-Linnæan literature of fishes. With the completion of this checking, the search for missing titles ended, and the work of editing these cards into standard form began. On August 20, 1920, the first batch of Addenda cards—4029 in number—was sent to the

printer. Other titles came to us later and incidentally in the course of the work, and were added from time to time until the Addenda now embraces in round numbers 4500 titles and covers 203 pages of Volume III. In the same way the section of Pre-Linnæan titles (i.e., from the beginning of printing until 1758), which (left incomplete at Doctor Eastman's death) numbered about 1000 citations, was expanded to 2300 entries covering 130 pages. This Pre-Linnæan material is of value mainly, of course, because of its historical interest, but as it was realized that in all probability never again would an effort be made to "bibliograph" this ancient literature, I endeavored to make it as complete as possible.

During the fall and winter of 1919 "copy" steadily went forward to the printers (The University Press, Cambridge, Massachusetts), and proof came back, and the interminable work of proof-reading began. At this time and in fact for the next year, one great difficulty was to keep *all* parts of the Bibliography moving simultaneously. This was particularly true with reference to getting the Addenda and Pre-Linnæan sections along so that they might not delay the notations for the Subject Index and the making of the cards.

Final page proof had been read on the Addenda and Pre-Linnæan sections and these were ready to go to press early in March, 1921, when a printers' strike occurred in the Boston region and prevented our printers from doing anything but piecemeal work for more than nine months. Fortunately, however, this did not cause us any ultimate delay, for the editorial work went steadily forward. We were particularly lucky in having page proof sheets of the Addenda and Pre-Linnæan sections wherefrom to complete the notations for the index cards.

By June, 1921, I had finished the four small sections of "General Bibliographies which Include References to Fishes," "Voyages and Expeditions which Relate to Fishes," "List of Periodicals Relating to Fish and Fish Culture," and "Errata and Corrigenda." These subjects in all cover but twenty-two pages— a space out of all proportion to the time and trouble required to gather the data and present them in proper form. As soon as these sections were off my hands, I gave attention to those topics of the Morphological Section of the Subject Index which had more or less fallen within my lines of investigation, and in the intervals of proof-reading, I worked steadily on these with Mr. Henn for the next fifteen months.

Meanwhile Mr. Henn had finished the task of annotating the proof sheets of Volumes I and II, and of the Addenda and the Pre-Linnæan sections of Volume III for the index cards. These were typed and distributed under the great headings to which they severally belonged. Now began the tremendous task of digesting these 150,000 or 200,000 index references into an intelligible and usable form. This was done by Mr. Henn first for the great section Palæontology. The classification of this large mass of material was fairly easily worked out, but the choice of the types perplexed us considerably. Had we had an unlimited amount of money, enabling us to use all the styles and sizes of types in the print shop, and could these have been set by hand, this problem would have been comparatively easy of solution. However, as it was, we were limited for our great headings, our sub-heads, and sub-sub-heads down to the most subordinate paragraphs to the two sizes and three styles of type which could be set from two plates on the monotype machine.

These limitations of types called for the utmost ingenuity on the part of Mr. Henn, to whom is mainly due the credit for the format of the Subject Index as well as for the majority of the subjects therein contained. The accompanying reproduction of a page of the Subject Index gives some idea of the sizes and styles of type used.

"Palæontology" went to the printer on January 13, 1921, and early in February we received the proof. Mr. Henn was now at work on another great section "Fauna of the World," but before it could be set the printers' strike in Boston occurred. Galley and page proofs covering the Addenda and Pre-Linnæan sections had, however, been read and we were therefore prepared to go to press with these 338 pages. In the meantime the work of arranging the vast material under the headings in the Morphological Section of the Subject Index went steadily on.

In September, 1921, Miss La Monte resigned to go abroad. Her place was taken by Miss Elsie M. Heinrich, who gave us loyal service until she was forced to resign by reason of ill health in June, 1922. However, Miss La Monte returned to the Museum in October, 1922, and devoted her attention to

# VIII

## SUBJECT INDEX

### SYSTEMATIC SECTION[1]

**CEPHALOCHORDATA** (*LEPTOCARDII OR LANCELETS*)

**Marine acraniate fish-like chordates.**

*General treatise.* Delage, M. Y. & Hérouard, E. 1898.1; Willey, A. 1894.1.

*Classification and geographical distribution.* Tattersall, W. M. 1903.1. — *For a map showing the geographical distribution of the Cephalochordata, see* Herdman, W. A. 1904.1 (*p.* 138).

*Taxonomy of forms from — Maldive and Laccadive Islands.* Cooper, C. F. 1903.1; Parker, G. H. 1904.3. — *Japan.* Jordan, D. S. & Snyder, J. O. 1901.12. — *Ceylon.* Tattersall, W. M. 1903.2.

**Family Amphioxididæ**

**Amphioxides** (*A pelagic form*). *Taxonomy and relationships.* ★Goldschmidt, R. 1905.1, 1906.1, 1909.1, Add. **1905.1.** — *Review of the above.* Willey, A. 1906.1.

**Family Branchiostomidæ**

Marine littoral forms

*Taxonomic revisions of genera and species.* Gill, T. N. 1895.2; Jordan, D. S. & Snyder, J. O. (*Japan*) 1901.12; ★Kirkaldy, J. W. 1895.1, Add. 1894.1.

**Amphioxus** (**Branchiostoma**). *Natural history, descriptions of young, etc.* Bert, P. 1867.1,.5; Clark, H. J. 1865.1; Harting, P. 1876.1; Kemna, A. 1906.1; Krause, W. 1898.1; Lindsay, A. 1857.1; Müller, J. 1839.1, 1841.2; Quatrefages, J. L. 1845.1; Reichert, C. B. 1870.1; Rice, H. J. 1878.1; Schultze, M. J. 1851.1; Schneider, A. F. 1878.1; Sundevall, C. J. 1840.1; Sundewall, F. 1843.1; Willey, A. 1891.1, 1901.1; Yung, E. J. 1906.1; Putnam, F. W. Add. 1865.1.

*Phylogenetic relationships. — Relation to Balanoglossus.* MacBride, E. W. 1897.1. — *Amphioxus a slightly metamorphosed tunicate (with consideration of homologies).* Wijhe, J. W. 1906.1, 1914.1,.2. — "*Amphioxus and the ancestry of the vertebrates.*" Willey, A. 1894.1.

**Asymmetron.** *Natural history notes.* ★Andrews, E. A. 1893.1; Benham, W. B. 1901.1, 1901.2; Mark, E. L. 1904.1; Römer, F. 1896.1; Willey, A. 1896.1.

**Epigonichthys.** *Natural history.* Harting, P. 1877.1; Passzlavsky, J. 1877.1; Peters, W. C. H. 1876.1.

**CRANIATA**

**Animals (Vertebrate) distinguished by the possession of a definite "head."**

**CLASS CYCLOSTOMATA**, *OR MARSIPOBRANCHII.*

**Aquatic craniates without true jaws.**

*For parasitic habits of Cyclostomes, see under* Parasitic Fishes, *also pp.* 416 *and* 500.

*Natural history.* Duméril, A. M. 1812.1, .2; Partiot, L. Add. 1848.1; Thomson, J. A. Add. 1912.1.

*Taxonomy and systematic relationships.* Dean, B. 1900.1; Gill, T. N. 1883.7; ★Howes, G. B. 1892.1; Woodland, W. N. 1911.4. — *Supposed gnathostome ancestry of Marsipobranchii.* Woodland, W. N. 1913.2.

*Taxonomy of species found in — Russia.* Berg, L. S. 1906.10. — *Japan.* Jordan, D. S. & Snyder, J. O. 1901.12. — *Australia.* Ogilby, J. D. 1896.2.

**ORDER MYXINOIDES**
**(Hyperotreti)**
**Hag-fishes or Borers**

*For a map showing the geographical distribution of the Myxinoides, see* Meek, A. 1916.1 (*p.* 31).

[1] Arranged in general according to the system used in the Cambridge Natural History — this for convenience.

Confined chiefly to natural history, occurrence and the larger and more recent papers on fossil forms and taxonomy. Rarely going below genera, save in the case of the fishes of great economic as well as scientific importance (i. e. Anguilla, Pleuronectidæ, Salmonidæ, etc.).

For further data on natural history, *see* Habits, Reproduction, etc., *in* Morphological Section. For further references to fossil fishes, *see the elaborate section* Palæontology, *also* Hay, O. P. 1902.1, *and* Woodward, A. S. 1889.2, *and also the* Bibliography of North American Palæontology *cited in* Part IV, General Bibliographies. For further data on taxonomy and occurrence, *see section* Fauna of the World, and for particular regions, see such great faunistic and taxonomic works as Day, F. 1875.1, Boulenger, G. A. Add. 1909.1, Eigenmann, C. H. 1912.2, Goode & Bean, 1896.1, Jordan & Evermann, 1896.1. For new species, *see* Zoological Record.

For all other subjects, *see* the Morphological Section.

A PAGE FROM DEAN'S "BIBLIOGRAPHY OF FISHES"

This page, only one of 305 that constitute the Subject Index of the monumental Bibliography, may serve as a suggestion of the painstaking editorial labor required in dividing the vast literature of fishes into sub-headings and sub-sub-headings and in selecting for each entry a style and size of type that enables the reader at a glance to associate it with entries of corresponding value and to differentiate it from larger or from subordinate classifications

the Bibliography until the last card was ready to be sent to the printer in 1923.

Mr. Henn's work on the Subject Index was twice considerably interfered with. In 1920, he was appointed curator of fishes in the Carnegie Museum, Pittsburgh, Pennsylvania. Dr. W. J. Holland, then director, seeing how badly Mr. Henn was needed for the Subject Index (the work of which he had initiated and had carried on alone until I joined him in June, 1921) and fully appreciating the value of the Bibliography to science, kindly agreed to let him stay with us until this index was completed. It was necessary, however, for Mr. Henn to go to Pittsburgh at intervals to examine the fish collections and see that everything was in proper order. He was away for about two months in the fall of 1920 and for about four months in the winter of 1921–22. During his second absence I worked over all the index material not completed and in the hands of the printer, and got it into shape for more rapid handling on Mr. Henn's return.

In the meantime the strike had ended and early in 1922 we began to receive proof with fair regularity while on January 24 the bill of lading was received for the printed sheets of the Bibliography up to page 320. In the fall of 1922, Doctor Holland, feeling that Mr. Henn had been permitted to remain with us as long as he could possibly spare him, and that the work of the department of ithchyology of the Carnegie Museum was suffering by reason of his absence, called for him to come to Pittsburgh, and on November 9, Mr. Henn severed his connection with the Bibliography for good.

At the time of his departure the situation was not exactly reassuring, for notwithstanding the help that I had been able to give in the fifteen months that I had worked on the Subject Index, there was much left unfinished. Naturally, as the work progressed, omitted items were picked up, errors were detected, faulty and erroneous titles were cleared up, resulting in considerable changes in various sections of the Subject Index, through cutting out here and adding there. This material was held until the last; insertions and deletions were then made in the galley proofs of the Morphological Section, and at that time, too, the sizes and styles of type were made uniform throughout. These proofs had to be read not merely word by word and date by date, but letter by letter and figure by figure. And now was realized how wisely the poet wrote when he said, "To err is human." Mr. Henn asked that the final proofs be sent to him at Pittsburgh, and these received the benefit of his careful reading.

With this off our hands there yet remained undone one large section which Mr. Henn (far better fitted to handle it than I) had left incomplete. This was the Systematic Section, of which only the sub-sections Anguillidæ, Salmonidæ, and part of Pleuronectidæ were done. However, there was no one else to do this Systematic Section, so with the constant advice and help of my colleague in the department, Mr. John Treadwell Nichols, this was finally arranged, following the general classification set out in the *Cambridge Natural History*.

This work was lightened and its bulk reduced in two ways. First, there had been left in the Systematic Section great masses of material which were now brought out and inserted under various sub-headings of the Morphological Section, or made into such great group headings as "Aquarium Fishes" and "Anatomy and Morphology." This relieved the situation greatly, and further reduction was obtained by following Doctor Dean's advice that we confine our taxonomic references almost entirely to revisions of families, genera, and species. For most genera and species the "natural history" references were retained, and where the fishes mentioned were rare or unusual or of great interest and value, there were listed in addition all the citations. For the complete literature covering all fishes the searcher is referred to such great faunal works as Boulenger's *Freshwater Fishes of Africa*, Jordan & Evermann's *Fishes of North and Middle America*, etc. This plan seems to have won almost unanimous commendation as has our adoption of the classification used in the *Cambridge Natural History*. Finally the large Systematic Section was completed and the last cards sent to the printer on April 27, 1923.

During all these years of prolonged brain-deadening work, Doctor Dean visited us every week or ten days and was the court of last resort in settling doubtful and disputed points. His advice and his optimism sustained us on many an occasion when we were almost ready to give in under the strain. Furthermore, he read all the proof and gave us much valuable advice and help in that connection. Indisputably he was the *Deus ex machina*.

The Subject Index, which is the *summa maxima* of our work, is composed of two sections: a Morphological and General Section of 254 pages with its 118 great headings and the Systematic Section of 51 pages—a total of 305 pages wherein the literature of fishes is minutely analyzed into hundreds of small headings and smaller sub-headings. To this there is a Finding Index of 41 triple-column pages in alphabetical arrangement. The total pagination of our combined index is therefore 346 pages.

While this work was progressing, Miss La Monte had for months, in the interval of other duties, been at work on this alphabetical Finding Index to the Subject Index. With the sending of the last of the cards of the Systematic Section to the printer, she devoted herself almost exclusively to the Finding Index until it was finished, and she finally left the service of the Bibliography about the first of July, 1923. Too much cannot be said of the intelligent, skillful, and faithful service she gave the Bibliography.

I was out of my office on account of illness from May 16 to June 15, 1923. On my return I at once set to work on the editing of the Finding Index cards and as soon as possible in July sent them to the printers. Galley proofs came promptly and were as promptly read and sent back. Final page proofs were returned August 14 and orders given to print everything up to the word *finis*. After some delay this was done, but to the very last the Bibliography proved itself the child of misfortune, for by an inadvertence when the final printed sheets were forwarded to us, the "front matter"—title page, preface, table of contents, etc.—was not included. The missing part was sent, however, at once by express. On its way here the containing crate was smashed and a large number of the sheets badly damaged. Sick at heart, I wired the printers, fearing that the monotypes had been melted and that this matter would all have to be set up afresh, causing another delay. However, the forms had been held, new sheets were printed, shipped at once, and received promptly.

Due to these delays, a new complication had arisen. The Bibliography was to be bound in the Museum bindery but had now lost its turn to the current issue of NATURAL HISTORY, which was just coming from the press, and to pile Pelion upon Ossa this issue of NATURAL HISTORY was a special edition, and therefore taxed the bindery to its capacity. However, on November 13, 1923, the first bound copy of the Bibliography was put into my hands, and our book was formally published.

And now that our task is done, too much cannot be said of the far-sightedness and the faith in the ultimate success of our work and of its value to science shown by President Osborn and the Board of Trustees, who through all these years of work—long drawn out, thanks to the war—have furnished the money to pay the salaries of those of us who have been privileged to do the task, and to provide for the far larger costs of publication. The debt of science to them is certainly very heavy.

At this writing the Bibliography has been distributed to a large number of ichthyologists and reference librarians, and from every quarter of the civilized world letters and reviews are arriving that speak in the heartiest terms of the inestimable and enduring value of our work—which covers every subject wherein fishes touch the life of man—and that declare it a landmark in the bibliography of scientific literature. And so the editors feel that, as Honorary Director Lucas wrote us on hearing that the final volume had come from the bindery,

*Finis coronat opus.*

# NOTES

## SCIENCE OF MAN

PROFESSOR VON LUSCHAN AND HIS SUPERB COLLECTION OF ANATOMICAL SPECIMENS.—Prof. Felix von Luschan, a distinguished German anthropologist, died last February. For many years he had been professor of anthropology in the University of Berlin and had held a corresponding position in the national anthropological museum of Germany. Though he was interested in all phases of anthropological research, his best-known contributions are in racial anthropology and the archæology of the Near East. He was a true field man and inspired all those around him with the spirit of inquiry. Naturally these qualities made him an ideal teacher and drew to his laboratories many foreign students, especially from the United States and England. The most interesting scientific contribution made by Professor von Luschan was his demonstration, before the modern theory of heredity came into general notice, that in mixed populations the two constituent original human types will continue to appear century after century instead of all individuals being leveled down to a uniform blend. For example, when a long-headed people mix with the round-headed, we may expect a number of medium heads to appear in their progeny, but also, according to the now accepted laws of heredity, there should be represented both long heads and round heads. Thus it was that Professor von Luschan first saw in human data what through the researches of De Vries and others led to an epoch-making discovery in biology.

On the other hand, Professor von Luschan was a great explorer and collector. He possessed one of the largest and most complete collections of anatomical specimens in existence,—the work of a lifetime. His series of human crania is representative of all living races of men from the extinct Tasmanian to the modern European and thus contains in itself the story of man's racial differentiation. Accompanying the material is a large series of photographs, extensive notes gathered during von Luschan's wide travels, and an unusually complete library. Just a few months before his death, Professor von Luschan completed arrangements to transfer this magnificent series of specimens and books to the United States and to deposit them in the American Museum. He believed that the scientific usefulness of the materials gathered during his long life would be greatly enhanced by placing them in America and in this Museum. So at the time of his death Professor von Luschan was superintending the packing of this collection for shipment to New York. Needless to say, this addition to the Museum's anatomical collections will make the institution one of the very best places in which to study human biology.

MR. CLARENCE L. HAY, who for many years has been engaged in archæological research in Mexico, was elected a member of the Board of Trustees of the American Museum at the annual meeting in February. Formerly a graduate student in Harvard University, where he specialized in Mexican archæology, Mr. Hay has for several years been carrying on his researches in the department of anthropology, American Museum. In that connection he has made frequent collecting trips to Mexico. He is now developing plans for an extension of the Museum building on Columbus Avenue, in which are to be housed, in artistic setting, the Museum collections from ancient America. President Henry Fairfield Osborn has appointed a committee to assist Mr. Hay in working out the architecture and other details. In general, the plan is to use full-scale reproductions of the best-known examples of Mayan and Aztecan sculpture as integral parts of the inner wall faces, thus in the end housing the exhibits within walls that are representative of their own time and place. In Mexico and Yucatan were realized the highest types of aboriginal American civilization and it is fitting that the proposed new hall, which will house examples of the archæology of these areas, should form the west entrance to the Museum.

DR. J. ALDEN MASON, of the Field Museum, has been appointed assistant curator of Mexican archæology in the American Museum. Doctor Mason has carried on extensive researches in Mexico and northern South America and is well prepared to take up the development of new work in this field.

Almost from the first, the American Museum undertook the accumulation of collections illustrating the wonderful cultures of aboriginal Mexico. Its first collection of Central American antiquities, that of the Hon. E. G. Squier, one of the early students

of the ancient American civilizations, was acquired in 1875. Later, under the generous patronage of the Duc du Loubat great impetus was given to research in the field of Mexican and Central American archæology, and the collections were greatly enriched both by exploration and by purchase. Among the early acquisitions made possible through the Duc du Loubat were casts of prehistoric sculptures from the Valley of Mexico, Chiapas, Yucatan, Guatemala, and Honduras, pottery and stone objects from Mexico and Guatemala, and reproductions of ancient codices, now on view in the Mexican hall of the American Museum.

In 1896 a concession for archæological exploration was obtained from the Mexican government, and work was begun under the direction of Prof. M. H. Saville, who explored the famous ruins of Mitla, and those of Xoxo and Monte Alban in Oaxaca, and of Xochicalco in Morelos. Professor Saville returned to Mexico in 1898 and again in 1900–03, and during these periods explored the curious cruciform structure among the ruins at Mitla, a model of which is in the Museum.

After Professor Saville withdrew from the Museum, Doctor Herbert J. Spinden, now of Harvard University, was appointed curator in this field, and carried on explorations from 1909 to 1920, not only in Mexico, but in other parts of Central America and the adjacent sections of South America.

In recent years, the Central American section has been greatly enriched by the unrivaled collection of Mr. Minor C. Keith, consisting of stone carvings, pottery, and gold objects.

It is not possible to enumerate here all the expeditions sent out by the Museum to gather materials for the Mexican hall, but acknowledgment can be made to the generous donors who financed these undertakings and to the many distinguished archæologists who made the field studies. Among the patrons are: Willard Brown, Austin Corbin, R. P. Doremus, Anson W. Hard, Archer M. Huntington, Morris K. Jesup, James H. Jones, Minor C. Keith, the Duc du Loubat, William Mack, Henry Marquand, Dr. William Pepper, A. D. Straus, I. McI. Strong, Cornelius Vanderbilt, Henry Villard, William C. Whitney. The archæologists include: George Byron Gordon, Aleš Hrdlička, Carl Lumholtz, Francis C. Nicholas, Marshall H. Saville, Eduard Seler, Herbert J. Spinden, and John L. Stephens.

So the appointment of Doctor Mason as assistant curator in charge of Mexican archæology inaugurates a new period in the development of the department of anthropology.

## NEW ACHIEVEMENTS OF THE FAUNTHORPE-VERNAY EXPEDITION

Additions to the Mammal Collection. —Mr. Arthur Vernay, who is extending the work of the Faunthorpe-Vernay Expedition into new areas of Burma, Assam, and Siam, has sent to the American Museum several reports, conveyed by bearers from the depths of the jungle, regarding the progress of the undertaking. In addition to Mr. Vernay and the officers and scientists associated with him, the expedition has a complement of 72 men—Indians, Shans, Korens, and others—and no less than 30 elephants for transporting the equipment and for driving out the concealed jungle beasts through an approach in line formation.

Writing from a camp established at Lampa in the Tenasserim Division of Lower Burma, Mr. Vernay states that he has secured in that locality specimens of the giant bamboo rat as well as of the smallest of these rodents, several interesting squirrels, a wild pig, and three bats (*Pteropus intermedius*),—the last-mentioned being caught in mouse traps appropriately baited!

In a later letter sent from a camp established on the La-oh Plateau he mentions that he obtained a fine young bull bison, standing 5 feet 3½ inches at the shoulder. This animal rounds out admirably the proposed bison group, for which there are available, in addition, an adult bull, a cow, and a calf. When Mr. Vernay wrote this letter (January 5), the specimens secured already totaled 280. Among the animals alluded to are gibbons, several monkeys, and specimens of the large squirrel (*Ratufa giganteus*). A cable dated March 14 contained the news that a prized specimen of a rare Malayan tapir had been bagged and that Mr. Vernay was about to leave for Assam to hunt buffalo.

Not only is Mr. Vernay zealously collecting himself but, desirous that no important area in or near India should be without faunal representation in the American Museum, he arranged to have an expedition sent to Kashmir, with the result that the Museum has come into the possession of many desiderata from that area.

BIRDS COLLECTED BY THE EXPEDITION.—Although the present expedition of Mr. Vernay has been fortunate in obtaining a representative collection of the smaller mammals, it has devoted its energies with conspicuous success also to the collecting of birds. It was with the purpose of securing, if possible, as complete a representation of the avifauna as of the mammalian fauna, that Mr. Vernay induced Mr. Willoughby Lowe of the British Museum, to accompany him. Seventy-five different species of birds were represented in the collection made during the first week in the field and a daily average of from twenty to thirty specimens in subsequent days has resulted in the addition of many other species, some of them being of great rarity. Among the more spectacular birds obtained are the Burmese peacock and peahen and specimens of the hornbill *Dichoceros bicornis*.

## BIRDS

BIRD COLLECTING IN CHILE AND THE ARGENTINE.—Dr. Frank M. Chapman, curator of the department of birds, returned to the American Museum in April after an absence of more than four months in Chile and the Argentine. Sailing from New York on Thanksgiving Day, accompanied by Mrs. Chapman, Mr. F. C. Walcott, and Miss Helen Walcott, he joined Lord William Percy on Christmas at Puerto Montt,—the end of rail service in Chile. Here the party chartered a small steamer and for ten days explored the islands south and east of the island of Chiloe, where an expedition from the Field Museum of Chicago was engaged in collecting some time ago. Motion pictures taken by Mr. Walcott, studies of the flightless steamer duck made by Lord Percy, the discovery of penguins nesting in luxuriant forests associated with humming birds, and specimens as well as still pictures of nearly all the species observed are the principal results of this cruise.

A return was made to Puerto Montt and there the party divided, to reassemble later. Lord Percy continued his study of ducks along the coast of the mainland, Mr. Walcott went to Bolivia to investigate flamingo "rookeries," and Doctor Chapman accepted an invitation from the Hon. William M. Collier, the United States Ambassador to Chile, to accompany him to Punta Arenas. Crossing the Gulf of Peñas and sailing along the coastal islands and the mainland on to the Straits of Magellan, Doctor Chapman had an excellent opportunity to view the country where Darwin made observations during the memorable voyage of the "Beagle." From Punta Arenas a crossing to Tierra del Fuego was effected by gunboat. There American motor cars met the party and when later the travelers returned to the mainland, other motor cars took them northward 150 miles along the eastern base of the Andes.

On the way from Puerto Montt to Santiago a stop was made in the Cordillera east of Temuco for the special purpose of viewing the *Araucaria* forests. Doctor Chapman obtained an excellent series of photographs of the fruit and habit of growth of this tree, but he could not discover that any birds are associated with it. In Santiago he rejoined Mr. Walcott, who had completed most successfully his side trip in search of the flamingoes, and the party proceeded to Puente del Inca, a station at an elevation of 9000 feet on the Argentine side of the Trans-Andean railroad.

Here studies and collections were made for what should prove to be a most impressive habitat bird group. The background will offer a superb view of Aconcagua in a setting which naturally lends itself to group construction. The dominant bird will be the condor, with other characteristic upper life-zone species, including seed snipe and a humming bird.

At Chascomús, only three hours south of Buenos Aires, material was obtained for the construction of a group representing the bird life of the pampas and lagoons. Here a combination of grassland and lake brings together such forms as the rhea, various tinamous, the crested screamer, the black-necked swan, the flamingo, and other almost equally interesting types. This locality has the additional advantage of being in the region of which Hudson wrote. All the species in the proposed group appear in his books and as a result the popular value of the group is greatly enhanced.

As a further evidence of the success of the trip it remains only to state in conclusion that Doctor Chapman succeeded, in addition to his field work, in arranging certain important exchanges, which will add several species and at least one genus to the collection of birds in the American Museum.

DR. ROBERT CUSHMAN MURPHY, assistant director of the American Museum and associate curator of its department of birds, has been elected a member of the Association of

American Geographers, which is devoted to the cultivation of the scientific study of geography in all its branches and is limited as regards its membership to individuals who have done original work in some branch of this science. There are at present 138 individuals who have been honored by membership in this society.

THE CATTLE HERON.—Mr. James P. Chapin in an article of this issue has called attention to the service which one African bird (the honey guide) performs while seeking its own ends. To the cattle heron (*Bubulcus ibis*) man is indebted in even larger measure, though its good actions, confined to the control of insect pests, have not the spectacular interest that attaches to the behavior of the honey guide. It is estimated that in 1920 these insectivorous birds saved in Egypt alone crops to the value of £2,000,000 or £3,000,000. Yet only eight years prior thereto herons had been dangerously reduced in numbers through the persistent persecution of plume hunters and, had not protective measures been set on foot at that time under the patronage of the late Field Marshal Earl Kitchener, agriculturists in Lower Egypt would probably ere this have been deprived of the services of a useful ally. The birds derive their name from the fact that they are usually found in association with cattle, but they may be seen also with other domestic and wild animals, snapping up the insects, especially grasshoppers, that are driven out of the high grass by the quadrupeds as they move about grazing. Sometimes the birds will alight on the backs of elephants, finding these pachyderms a convenient perch in country where dense, high growth of vegetation makes progress over the ground rather difficult.

## PUBLIC EDUCATION

AN EXPEDITION TO SWEDEN AND LAPLAND.—Thanks to the generous coöperation of the Swedish State Railways, the American Museum has been enabled to send an expedition to Sweden for the gathering of important data. Dr. G. Clyde Fisher, curator of visual instruction, has been entrusted with the leadership of the undertaking, and is fortunate in having associated with him Mr. Carveth

*Courtesy of Dr. L. Bayer*

Cattle herons at Entebbe, Uganda

Wells, F. R. G. S., whose sparkling lectures have on more than one occasion delighted members of the Museum and their children.

Doctor Fisher and Mr. Wells sailed May 10 on the S. S. "Drottningholm," Swedish American Line, for Gothenburg, whence by the River and Lake Route of the Göta Canal they will proceed to Stockholm.

As one of the purposes of the trip is to make a study of the Swedish educational system, they will visit elementary and secondary schools, universities, museums, and other centers of learning. Attention will be paid to sloyd work in its native home, for it is proposed to inspect one or more of the schools in which this system of manual training is emphasized. Upsala, the seat of one of Sweden's complete universities, founded before Columbus discovered America, will be included in the itinerary. An added interest here is the fact that Upsala was the home of Linnæus, "The Father of Modern Botany," who is perhaps as well known to zoölogists as to botanists due to his system of scientific names for animals and plants, which he devised in the middle of the eighteenth century and which is still the basis of our scientific nomenclature. The university center of Lund will also be visited.

Leaving southern Sweden behind, Doctor Fisher and Mr. Wells will travel northward by rail to Porjus, from which point they will go by motor boat up the Stora Lule-älv River as far as it is navigable; thence into the wilderness quite off the beaten track of the casual tourist.

Here it is hoped that both a still- and motion-picture record of the country and life of the Lapps may be secured. Doctor Fisher and Mr. Wells will also make a study of the extremely interesting and, in some ways, unique flora and fauna of the region. Since they will be working within the Arctic Circle during June and July, not the least of the points of interest will be those correlated with "The Land of the Midnight Sun."

It is only recently that Doctor Fisher and Mr. Wells visited Bermuda and there made motion-picture records of the wonderful under-water life—the coral gardens and angel fish—in addition to obtaining many excellent still pictures. On April 3, the occasion of John Burrough's birthday, Doctor Fisher lectured to Bermudians and sojourners in the islands upon the great naturalist, of whom he has so many intimate memories and such a fine series of pictures. It was on this anniversary that Doctor Fisher saw for the first time the interesting long-tailed tropic birds that had attracted the notice of Burroughs during his sojourn in Bermuda, and by a curious coincidence he viewed them from the very spot where Burroughs had gazed upon them, and in the company of the Bermudian novelist, Miss Minna Caroline Smith, who was with Burroughs when he made the observation.

## ERRATA

The attention of the editor has been called to an error in connection with the full-page picture on p. 221 of the issue of NATURAL HISTORY for May-June, 1922. The picture shows a party collecting fossils in a cliff near Peking, and as it is credited to Mr. Walter Granger, palæontologist of the Third Asiatic Expedition, a reader would naturally draw the conclusion that it represents the activities of that expedition. The photograph was, however, not taken by Mr. Granger but by Dr. J. G. Andersson, of the Geological Survey of China, and depicts the work of that organization at Chou-K'ou-Tien, in the Province of Chihli. The picture had been presented to Mr. Granger and for the sake of convenience placed with photographs of his own work. During Mr. Granger's absence in Szechuan, Mr. Roy Chapman Andrews, desirous of giving emphasis in the article he was then preparing for NATURAL HISTORY to Mr. Granger's achievements, selected from among the photographs this print, not unnaturally believing it to be Mr. Granger's. The unfortunate error has at least this offset, that it gives opportunity again to direct attention to the important work that is being done by the Geologic Survey of China. In the issue of NATURAL HISTORY for January-February, 1921, a detailed account was given of this organization, while in the issue for January-February, 1924, mention was made of some of the valuable results which it has achieved and of the program of work still to be undertaken.

Confession is reputed to be good for the soul, incidentally it is good for a proper understanding of the facts. An additional error is, therefore, noted: the formation shown in the picture is described in the caption as loëss; it should have been referred to as limestone.

The picture of the excavations at Chou-K'ou-Tien has been used by Dr. Otto Zdansky in his account of this fossil locality published in the *Bulletin* of the Geological Survey of China, No. 5, October, 1923.

## CONSERVATION

THE JOHN BURROUGHS MEMORIAL ASSOCIATION held its third annual meeting in the American Museum on April 3 under the presidency of Dr. Frank M. Chapman. The association is dedicated to the purpose of preserving, in the spirit of John Burroughs, the places with which his life and work are as irrefragably linked as is Selbourne with Gilbert White or Walden Pond with Thoreau. Thanks to the vigilance of the special committees of the association—the one charged with the preservation of Woodchuck Lodge, the other with the maintenance of Slabsides—these two dwellings are being safeguarded as much as possible from the assaults of time and weather and, when renovation becomes imperative, the replacements are either duplications of the original parts or harmonious additions thereto.

The abiding interest in Burroughs is well illustrated by the fact, reported by Dr. Clara Barrus, of the Woodchuck Lodge Committee, that from the middle of September to the last of October—at a season, in other words, when the summer pilgrimages to different places are at an end—nearly 1200 people visited the spot where Burroughs spent his boyhood and where he lies buried.

After a report by Mr. John Shea, chairman of the Slabsides Committee, regarding the steps taken to keep Slabsides as nearly as possible as Burroughs left it, Doctor Chapman read an entertaining letter from Theodore Roosevelt, assistant secretary of the Navy, telling of a visit which young Roosevelt paid at the age of eleven, when his distinguished father was governor of New York State, to the home of the naturalist. This visit had a curious sequel, which Doctor Chapman illustrated through lantern slides. A phœbe, rather needlessly resentful of the fact that a little boy had taken a peep in her nest, flew to a house near Slabsides and there started a new home on one of the numerous beams under the roof of the porch. Presently she lost her bearings, bewildered by the series of parallel beams of like structure that offered support for a nest. In her perplexity she laid the foundations of a second home and then a third. With three nests under way the deluded bird flew from job to job, not knowing how to divide her time between her several building projects,—a dilemma similar to that of the donkey which, dialecticians claim, starved to death while trying to decide which of two piles of hay of equal attractiveness and of equal proximity it would munch. It was at this crisis in the bird's affairs that Mr. Burroughs helped her to concentrate her activities by demolishing two of the uncompleted nests.

The slides shown by Doctor Chapman were supplemented by others illustrative of the environment in which Burroughs spent his days, and finally, as a culmination of the session, the artist, Mr. Wickenham, explained the circumstances connected with the several admirable oil paintings from his brush of subjects near Burroughs' birthplace that ornamented the walls of the room in which the gathering was held.

THE FARNE ISLANDS, lying off the northeast coast of Northumberland, have been used as a breeding station by more than twenty species of sea birds, that congregate there in numbers. The nearest island of this group of fifteen is only three miles from the mainland and, as often happens under such circumstances, the bird life has become imperiled through the visits of individuals who are wantonly destructive. It is the proposal to purchase these islands and to have them more adequately guarded than is now possible. Funds in support of this worthy object may be sent to Mr. Collingwood F. Thorp, of Belvedere, Alnwick, England.

THE NATIONAL CONFERENCE ON STATE PARKS was held in Gettysburg, Pennsylvania, from May 26 to 28 and was attended by an interested group of delegates. At the request of Prof. Henry Fairfield Osborn, Mr. Barrington Moore represented the American Museum at the gathering. The success of these conferences may be gauged by the growing response on the part of official bodies and private associations to the measures urged. Since the last conference, for instance, Kentucky has passed a state park law; West Virginia, Louisiana, and Texas have created state park associations; in Tennessee there is a movement under way to establish a state park around Reelfoot Lake; and California is working on a plan for its state parks. It is to be hoped that the developments of the months ahead may reflect in like manner the interest shown by the present conference in the extension of the park movement.

## NEW YORK ZOOLOGICAL SOCIETY

IN MEMORY OF MRS. RUSSELL SAGE.—An impressive ceremony took place on April

15, near the well-known rocking stone[1] in the New York Zoological Park. An oak tree was planted by the Conservation Committee of the New York City Federation of Women's Clubs "in grateful memory of Mrs. Russell Sage, foremost woman philanthropist of the world in the bestowal of wisely chosen benefits upon science, art, literature, education, and the welfare of humanity." Although Mrs. Sage's benefactions had the broad foundation indicated, conservationists will feel that her memory is more fittingly preserved through the planting of a tree than through any other symbol of her public-spirited interests. Just as the memory of Burroughs and Muir is literally kept green through the pin oaks planted in front of the American Museum, so the important part Mrs. Sage has had in assuring the preservation of the wild life of the country will be commemorated each recurring spring in the beauty of foliage of this memorial tree, a symbol of her perennial interest in the world of living and growing things. Through the permanent wild-life protection fund she established; through the Sage Game Sanctuary on Marsh Island, Louisiana; and other wise provisions in the interests of conservation, she has made a lasting contribution for which all nature lovers are deeply grateful.

The tree-planting ceremony was preceded by a procession and the delivery of a eulogy by Dr. William T. Hornaday, director of the New York Zoological Park, and was followed by the recital, by Mrs. Charles Cyrus Marshall, of the poem "Park Trees," written by Margaret E. Sangster.

In the afternoon the New York City Federation of Women's Clubs held a session, under the chairmanship of Mrs. Marshall, on conservation of wild life. Mrs. Thomas Slack, president of the organization, delivered the greeting; Mrs. Otto Hahn, the secretary, presented the report of the conservation committee; Senator Elwood M. Rabenold, chairman of the State Senate Committee on Conservation, spoke on "The Conservation Outlook Today," the St. Cecelia Choral Society sang Joyce Kilmer's "Trees," and Doctor Hornaday delivered an address on "Our Campaign for Retrenchment and Reform."

THE TROPICAL RESEARCH STATION of the New York Zoological Society has contributed an interesting exhibit of its work at Kartabo, British Guiana, to the Empire Exhibition recently held in London, both as testimony of the nature of its undertakings and as a tribute to the continuous support which the government of British Guiana has given to the station. Included in the material sent were a number of pictures, for it was felt that through such photographic records could be conveyed more effectively than in any other way the natural interest of the site and the facilities for scientific work that the station offers. The studies in water color made by Miss Isabel Cooper of insects, reptiles, birds, and mammals, were represented, and a large oil painting of the station was a prominent feature.

[1] A photograph of this stone appeared in the issue of NATURAL HISTORY for September-October, 1922, p. 433.

## EXTINCT ANIMALS

A SURVEY OF PLIOCENE FAUNA AND STRATIGRAPHY.—The department of vertebrate palæontology, American Museum, has been engaged since 1910 in making a very accurate survey of the Age of Mammals, beginning with the Eocene of northern New Mexico, Utah, and Wyoming, which has been explored in the greatest detail, especially through field expeditions under the direction of Mr. Walter Granger. Precise study of these collections in the Museum by Professor Osborn, Doctor Matthew, and Mr. Granger has yielded the entire life history of Eocene time, showing especially the connections with western Europe and with Mongolia. The next period, the Oligocene, is now being studied with great precision by Professor Sinclair of Princeton. The Miocene east of the Rocky Mountains is being especially surveyed by Curator Matthew, with the coöperation of Mr. Harold Cook. West of the Rocky Mountains, the Miocene is now being examined, likewise with great thoroughness, by expeditions under the direction of Dr. John C. Merriam, president of the Carnegie Institution, who has also conducted epoch-making explorations of the Pliocene in the Great Desert of the Pacific Slope, that have resulted in the discovery especially of unsuspected migrations of Asiatic antelopes into North America. The Pleistocene, or Ice Age, has been studied in detail during the past twenty years by Dr. O. P. Hay of the Carnegie Foundation.

There remains the problem of the Pliocene east of the Rocky Mountains, from the Mexican border northward into Nebraska; also the Pliocene of Florida. This is the least-

known and the least-understood part of the Age of Mammals in this great region, because the fossil deposits are so sparse and so scattered. Yet we feel confident that it contains a fossil store of surpassing interest, because of great migrations both from Asia and from South America.

For the purpose of making possible research in this period of the Age of Mammals, one of the Trustees of the American Museum, Mr. Childs Frick, has contributed the Pliocene Fund, in addition to conducting field work of the utmost importance and interest, especially in southern California. Mr. Frick has been working for several years, with the assistance of the staff of preparators and artists, upon certain papers that will be published in *Bulletin* and *Memoir* form. These include: (1) "Description of New Material from the Pliocene of Eden, California, and the Pleistocene of El Casco, California," (2) "Description of New Material from the Barstow Region of California," (3) "Bears and Aberrant Dogs of the late Tertiary and Quaternary," (4) "Horses of the North American Pleistocene."

The plan of the present year includes the survey of the Pliocene of Florida by Curator Matthew, whose recent visit to Florida is the subject of the following note, and the exploration of the Pliocene of northern Arizona and central Texas by Dr. James W. Gidley and Curator Matthew.

Fossil Localities in Florida.—Dr. W. D. Matthew spent the month of March in Florida, examining various localities for fossil vertebrates and studying specimens in museum and private collections. Many fossil mammals have been found in different parts of the state, but most of them in a fragmentary condition and scattered, and their exact geologic age has often been doubtful. Most of the fossils come from the phosphate workings in the central part of the state. Florida, as many readers of Natural History know, is the great phosphate state of the Union. It supplies about nine-tenths of the phosphates mined and used in the United States, and a great part of the European supply. The later Tertiary formations that cover a great part of the state contain almost everywhere a considerable percentage of phosphate of lime, but not enough to be profitably extracted. The workable phosphate deposits are concretionary layers and masses in which the phosphate of lime is sufficiently concentrated to make its removal profitable. In the "hard rock phosphate" district these deposits are in pockets and lenses upon the very irregular surface of marine limestone, and covered by a layer a few feet or yards deep of surface soils. Farther south in the "land pebble phosphate" district these phosphatic beds have been overrun by the sea. the phosphates broken up into pebbles and redeposited as conglomerate lenses and layers over a limestone floor planed down by the waves to a more uniform surface. As in the district farther north, a surface covering or overburden, ten, twenty, or sometimes fifty feet in thickness, overlies the phosphate bed. The river pebble phosphates, dredged from the channels of various streams, are due to a similar concentration of the phosphate concretions—pebbles, fossil teeth, and bones—through the action of rivers and streams.

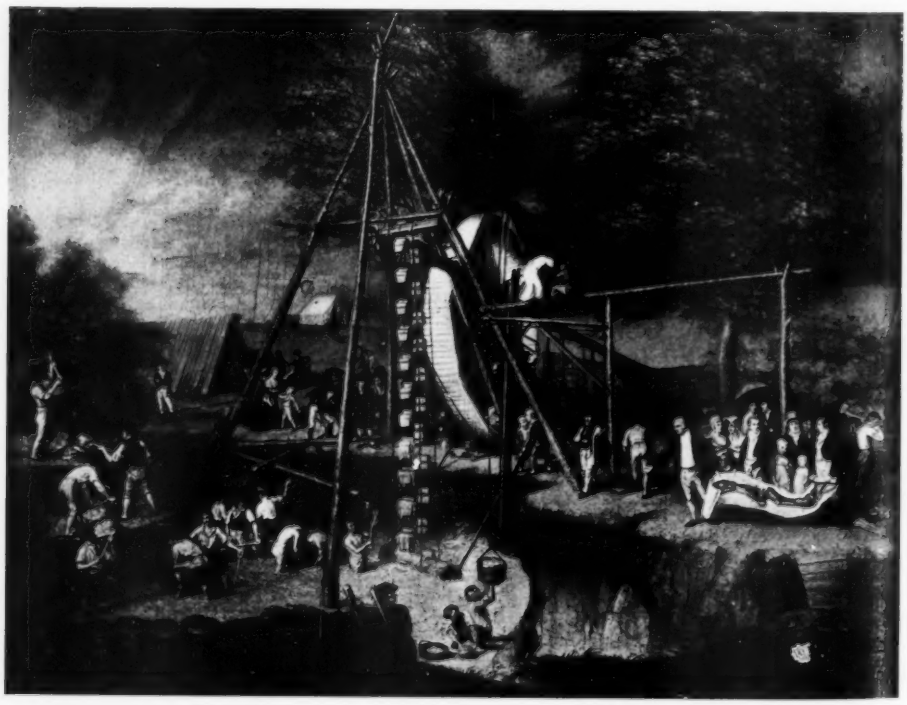
The mining is done on a huge scale, with sand pump, dredges, hydraulic jets, elaborate machinery for crushing, washing, sorting, and concentrating the phosphate, which is then shipped off to be treated with sulphuric acid or otherwise made available for fertilizer. Fossil teeth or bones show up every now and then, occasionally a lower jaw, and even fairly good skulls have been found, but probably far more has been destroyed in the course of operations than has been preserved. There is no practical safeguard against such loss except to maintain and increase the interest that is quite generally shown by the managing staff of the principal mining companies, and by the more intelligent workmen, in any fossils that are seen, especially the unusual ones. The American Museum and other institutions are under obligations to these gentlemen for various important or interesting fossils saved and presented to them. The American Museum in particular is indebted to Mr. Anton Schneider and Mr. H. L. Mead, present manager of the pits of the American Cyanamid Company at Brewster, Florida, and to Prof. C. R. Halter of Southern College, Lakeland, for a number of very interesting fossil mammal specimens from the pebble phosphate district.

The concretionary phosphates probably have been forming wherever the conditions were favorable ever since the land emerged above sea level, and the bones and teeth of the animals associated with them have been buried, preserved, and petrified at various times from the middle part of the Tertiary

period down to the present. Under such circumstances, there is sometimes an admixture of species of very different age, especially in beds that have been reworked by marine or river action. As a general rule, however, most or all of the fossils found in one pocket or excavation are of the same age; or, if not, the earlier remains and the later intrusions can usually be distinguished by differences in their preservation. With exact records of the finds and a practical knowledge of the faunas found associated in the Western Tertiary formations, it is possible to distinguish several different faunas among the fossil mammals of Florida. Doctor E. H. Sellards, the former state geologist, has done a great deal of very excellent work along this line, and it is to be hoped that the present staff of the Geologic Survey will be enabled to continue the work in coöperation with various institutions and individuals interested in learning more of the geological history of the state. To the three faunas distinguished by Doctor Sellards—Miocene, Pliocene, and Pleistocene—Doctor Matthew was able to add a fourth and older one, at the base of the Miocene, and to add various items to the later faunas. Nevertheless, our acquaintance with the extinct Floridian mammals is still extremely scanty and fragmentary, and a great deal will probably be added to it in the near future.

In a later number some account will be given of the interesting fossil finds recently made in Florida by one of our life members, Mr. Walter W. Holmes.

THE EXCAVATION OF THE PEALE MASTODON.—Readers of Prof. Henry Fairfield Osborn's article on "Mastodons of the Hudson Highlands," contributed to the issue of NATURAL HISTORY for January-February, 1923, will recall the historic painting by Charles Willson Peale that appeared in connection with that article. The picture has recently been lent to the American Museum by Mrs. Harry White and has been placed in the hall of horses on the fourth floor. In addition to its artistic value—the work of a painter to whom Washington gave fourteen sittings—this picture has documentary significance, for it records an event of interest in the history of palæontology and among those represented in the group of individuals witnessing the exca-



The excavation of the Peale Mastodon.—This historic painting has been lent to the American Museum by Mrs. Harry White

vation are the artist himself and members of his family. Charles Willson Peale is the conspicuous figure with the right hand extended and the left holding the diagram of the leg bones. The other figures immediately on the right of him are Mrs. Peale, Mrs. Rembrandt Peale, Titian Ramsay Peale, who was the naturalist of Long's Expedition and later of Wilkes's Expedition to the Antarctic and Pacific, the daughters of Rembrandt Peale, and Rembrandt Peale himself, who wrote a memoir on the mastodon.

## FISHES

EDWARD PHELPS ALLIS, JR.—Thirty years ago Edward Phelps Allis, Jr., began his career as the leading student of the head structure of fishes—skull, bones, muscles, nerves, blood vessels, sensory organs, foramina, cavities, mouth parts; practically all the organs of the head except the brain and the eyes. He founded the Lake Laboratory in the early nineties of the last century and was one of the founders of the *Journal of Morphology*. About twenty-five years ago, however, Doctor Allis moved his laboratory to Mentone, France, in the Riviera region, and from it has poured forth an unceasing stream of articles of the highest class along the various lines noted above.

Two papers are of particular interest. In 1922 there appeared his great memoir on the cranial anatomy of *Polypterus*, published in the *Journal of Anatomy*, Cambridge, England. Of so great value was this paper, that the Journal Club of the American Museum sent a letter of congratulation and good wishes to Doctor Allis on the completion of this important piece of research.

However, the particular paper calling forth this note is his "Cranial Anatomy of *Chlamydoselachus anguineus*, published in *Acta Zoologica*, Stockholm, 1923. In this contribution, 99 pages in length and illustrated by 23 magnificent plates (19 of them colored), Doctor Allis deals in a masterly fashion with the skull, visceral arches, muscles, laterosensory organs, circulatory organs, and nerves. The Japanese frilled shark—the subject of the paper—is designated by Samuel Garman, its original describer and first student, as a "living fossil." It is an archaic shark, not greatly changed in its general form and structure from its Devonian ancestors. Hence such a work as that of Doctor Allis is necessarily of a fundamental character, both by reason of its accuracy and because of the primitive form on which the researches are based.

In both these papers Doctor Allis pays high tribute to Mr. Jugiro Nomura, his Japanese assistant, who made the dissections and drawings, and who has since died.

These papers are of great interest to the scientific staff of the American Museum, particularly to those connected with the departments of ichthyology and comparative anatomy, not only on account of their morphological bearings, but also because the material on which Doctor Allis worked was supplied to him in large part by Dr. Bashford Dean, honorary curator of ichthyology, from specimens in the American Museum or secured by that institution.

FISHES TAKEN BY THE CONGO EXPEDITION.—Some years ago there appeared several reports dealing with the fishes brought back by the Congo Expedition of the American Museum (1909–15). The first,[1] by Messrs. John T. Nichols and Ludlow Griscom, was based on the collection of about 6000 freshwater fishes. Among the 234 forms represented, 4 genera and 29 species proved to be new to science. The second,[2] by the late Dr. Charles R. Eastman, noted many interesting and peculiar structures in the skull of *Hydrocyon*, generally called the "water leopard," the whole mouth of which is edged with an armature of long, dagger-like teeth. Comparison was made with the Cretaceous genus *Onchosaurus* and the recent South American *Hoplias*. The third,[3] by Dr. L. Hussakof, referred to the discovery of a new fossil fish. *Lepidotus congolensis*, from the Lualaba beds of the Upper Triassic near Stanleyville. This report also recorded from the Paleocene strata of Landana the first indication of teleosts in that formation.

In the large collection of fish were included about 250 salt-water specimens, collected near the mouth of the Congo River by Mr. Herbert Lang while he was waiting there for a ship to take to New York the rest of the material gathered during more than six years of field work. Recently the study of this part of the fish collection was undertaken by Mr. Henry W. Fowler, the well-known ichthyolo-

[1] *Bulletin*, Amer. Mus. Nat. Hist., XXXVII, Art. 25, 1917, pp. 653–756, 31 figs., 3 maps, Pls. LXIV–LXXXIII.

[2] *Bulletin*, Amer. Mus. Nat. Hist., XXXVII, Art. 26, 1917, pp. 757–60, 3 figs., Pls. LXXXIV–LXXXVII.

[3] *Bulletin*, Amer. Mus. Nat. Hist., XXXVII, Art 27, 1917, pp. 761–67, 7 figs., Pl. LXXXVIII.

gist of the Academy of Natural Sciences of Philadelphia.

In his preliminary report just issued,[1] Mr. Fowler describes one genus and four species as new to science. Especially noteworthy among these discoveries is a shark *Mustelus osborni*, named in honor of President Henry Fairfield Osborn, who encouraged the publication of the series of reports on the scientific results of the Congo Expedition. This series has now reached the seventh volume and reports for the next three volumes are practically ready for the press. Later, when the full series of volumes as originally planned by the president is published, the work will appear under the title *The Zoology of the Belgian Congo*.

*Centrarchops*, a new genus, belongs to the family Serranidæ, carnivorous fishes of warm seas. Its description is based upon *Centrarchops chapini*, so called after Mr. James P. Chapin, the second member of the expedition. Paradoxically enough, this, although new, is one of the common fishes of the Congo estuary and like its near relative *Lates nilotica* of the Upper Congo, one of the large and most highly prized food fishes. In addition to these there are two new forms belonging to families represented by a multitude of small species in the shore waters of the tropics: *Gobius bequærti*—named in honor of Dr. Joseph Bequært, an enthusiastic collaborator in this extensive series of reports—and *Blennius langi*, named after the leader of the Congo Expedition.

## MARINE LIFE

Bahaman Coral-Reef Group Expedition.—An expedition under the leadership of Dr. Roy W. Miner, curator of lower invertebrates, sailed for the Bahamas on June 6 to prosecute work on the coral reefs at Andros as a preliminary step in the work of constructing a large coral reef group to be placed in the splendid new hall of ocean life, now nearing completion. In order to collect trustworthy data for this group, Doctor Miner is undertaking a six or eight weeks' trip, accompanied by Messrs. Chris. E. Olsen, Herman Mueller, and George H. Childs, modeler, glass blower, and artist respectively on Doctor Miner's staff. The expedition will be financed by the Angelo Heilprin Fund, the Morris K. Jesup Fund, and the Trustees' Emergency Preparation and Exhibition Fund.

[1] *Novitates*, Amer. Mus. Nat. Hist., No. 103, 1923, pp. 1–6.

An important feature of the expedition is the undersea tube which has been made available for the work at Andros through the courteous coöperation of the Submarine Film Company, whose general manager, Mr. J. E. Williamson, will sail with Doctor Miner's party on June 6. Mr. Williamson is the pioneer in undersea photography and will operate the tube, which was invented by his father. His coöperation will add greatly to the success of the undertaking.

Valuable assistance has also been rendered, through Mrs. William Belknap, by the firm of A. Schrader's Son, which has donated a complete diving outfit with pump. This will greatly facilitate the problem of securing undersea specimens.

A week will be spent in outfitting at Nassau, after which boats will be hired for the passage across "The Tongue of the Ocean" to Andros, where a coral reef sixty miles in length follows the coast of the archipelago at a distance of about a mile. Here is an unlimited source of supply of the living material needed for the photographs, sketches, and other data to be collected. And here Mr. Williamson will bring his marvelous undersea tube, which forms an open-air passage through which one may descend to the observation chamber attached to its base, and sit comfortably with two or three companions gazing out over the ocean floor fathoms below the surface. Here one may study, sketch, and photograph the tropical marine life in its natural environment and direct the work of divers in collecting corals under such favorable circumstances as scientist never enjoyed before.

The group to be constructed as a result of this trip will be a replica of a West Indian coral reef, planned on a huge scale that will embrace both the floor and gallery of the hall of ocean life, rising to a height of thirty-five feet and extending to a width of thirty feet. On the gallery level will appear the coral island as it might look to an incoming boat, with its palm trees, expanse of beach and lagoon, waves breaking over the outer reef, and in the distance trade-wind clouds blowing over a tropical sky. Then, in descending to the lower floor, one puts on, as it were, a diver's suit and descends to the submerged part of the reef, where countless plants and animals of varied colors crowd over the ocean bottom and gay-hued fishes dart in and out among the rocks.

## INTERMUSEUM PROMENADE

### A BROAD AND SAFE PATHWAY FROM THE METROPOLITAN MUSEUM AT 80TH STREET EAST TO THE AMERICAN MUSEUM AT 79TH STREET WEST

PRESIDENT OSBORN'S APPEAL.—On Monday, March 31, a public hearing was held by the Board of Estimate and Apportionment on the matter of the proposed War Memorial, the reclamation of the lower reservoir, and the construction of the Intermuseum Promenade. President Osborn appeared on behalf of the Museum, in connection with the Intermuseum Promenade and the development of the lower reservoir space into a children's playground. An excerpt from his address is appended:

Since 1911 I have been promoting by every means in my power the present movement to turn the southern reservoir back into Central Park space, to create a new and large playground for the children of the city, and to design an Intermuseum Promenade between East 80 and West 79 Streets to enable the great population of the east and west sides of the city, respectively, to visit our two great museums. I have closely observed this great area of the park for thirty-two years. It separates two of the finest museums of the world by a barrier dangerous by day and impassable by night. School parties now pass through the park subway to attend the morning and afternoon lectures of the American Museum. Within the last two years parties of schoolboys have been attacked and robbed in passing through this area. When the State Roosevelt Memorial Commission met two years ago, I told them that this part of the park was very dangerous; two nights later a man was robbed and murdered within a stone's throw of the American Museum. With all these facts in mind, the mayor, the comptroller, the president of the Borough of Manhattan, and the Board of Estimate and Apportionment have had before them since 1911 the question of the redemption of this space. The plan now presented by Commissioner Whalen and Commissioner Gallatin represents ten years of continuous and conscientious study for the welfare of the people of New York.

One of the leading newspapers of the city has been opposing the promenade plan since February 9, 1916. Since then the colonnade known as the War Memorial has been substituted for the Mitchell fountain originally planned by Mr. Hastings. If you look at the site, you will see at once that the use of the open colonnade and lagoon is the only possible landscape-architectural solution of this problem. Between the upper reservoir and the lagoon there must be some dominant feature. It cannot be a forest, because a forest will not grow there; it can only be some form of building, and of all forms of building none solves the problem as does the colonnade. No other solution has been or can be suggested. To my eye the colonnade should be on a larger scale than Mr. Hastings has planned it. He intends to develop his plan with the aid of our Fine Arts Commission. In this matter of the War Memorial I speak from my own individual experience and judgment and represent no one but myself.

In the matter of the Intermuseum Promenade and the redemption of the southern reservoir and its conversion into thirty-two acres of new playground, however, I speak officially. This matter has been repeatedly before the Trustees of the American Museum and I have had their authority in strongly recommending it to the city. In fact, the American Museum has spent years of time and effort and a large amount of money to develop this plan. On May 10, 1916, the Museum first secured from the Department of Water Supply, Gas, and Electricity a promise to release the southern reservoir and return it to the park. The Museum is now taking the best professional advice obtainable. It is considered by the Museum an essential feature of the great Roosevelt Memorial plan that the Roosevelt Memorial should have a safe, adequate, and beautiful approach from the east side of the City. In its promise to the state the city is pledged to the Intermuseum Promenade plan, which will, I am confident, have the unanimous support of all our citizens.

President Osborn brings to the consideration of this subject an experience gained through association with many park projects. Since 1898 he has been an honorary member of the Boone and Crockett Club, founded by Theodore Roosevelt,—a club that played its part in furthering the great national park system in the United States. Since 1896, as chairman and president of the Zoological Society of New York, he has supervised the planning for the city of New York of an incomparable park and aquarium with an annual attendance of 5,000,000 people. Since 1869 he has been visiting and studying the park systems of the great cities of Europe and America. In laying out the Zoological Park he had twenty years of experience with many landscape architects of America, including the landscape architects of the park, Heins and Lafarge, the endeavor being to create a park at once beautiful, inspiring, educational, and practical. Since 1907 he has been a warm supporter of the Bronx Parkway movement under Madison Grant, which has given to New York the most beautiful exit parkway in the world, fifteen miles in length, and has solved a most difficult engineering problem. In 1915 he was chairman of the national movement to save the Hetch Hetchy Valley of California, ad-

joining Yosemite Park, from invasion by a municipal water plant. In 1917 he started, with Madison Grant and John C. Merriam, the national movement known as "Save the Redwoods," which at present under California leadership is redeeming the glorious redwood forests along the Pacific Coast.

## MAMMALS

THE AMERICAN SOCIETY OF MAMMALOGISTS held its sixth annual stated meeting in Boston and Cambridge from April 15 to 17. The sessions of April 15 were devoted to a symposium on the scientific and economic importance of predatory mammals. The subject was opened by Mr. H. E. Anthony of the American Museum and among the speakers that followed him was Mr. Herbert Lang of the same institution. Attention was called to the energetic measures which the Bureau of the Biological Survey is taking, over a large part of the United States, to exterminate the predatory animals as well as to complete the destruction of certain so-called mammal pests. The majority of the speakers deplored the far-reaching character of the measures taken and rather questioned their necessity, expressing the belief that the situation called for judicious control rather than complete extermination. So strong was the sentiment in favor of a less drastic mode of procedure that a committee was appointed, with Dr. Charles C. Adams as chairman, for the purpose of drawing up suitable resolutions.

The resolutions as drafted called attention to the fact that there is a dangerous propaganda abroad in the land because of this federal activity and that private interests are seizing the occasion to exploit the destruction of mammals, being actuated by hopes of financial gain. In view of these circumstances the president of the society was authorized to appoint a committee to go into the question and ascertain whether there are not some areas in which predatory animals might be spared from measures of extermination.

The symposium was attended by reporters from the Boston papers, who gave wide publicity to the views presented.

April 16 and 17 were devoted to subjects of a more miscellaneous character, including an account of "Small Mammals from the Asiatic Expeditions of the American Museum," presented by Dr. Glover M. Allen; a résumé of the work now being carried on by the Museum in Ecuador, given by Mr. Anthony; and two papers, one entitled "Variation in the Cranial Characters Due to Age in the African Viverrine Genus *Civettictis*," and the other "Comparison of Ecological Conditions in the West African Rain Forest with those of the British Guiana Forest, with Remarks on the Mammal Life," presented by Mr. Lang.

MR. H. E. ANTHONY, associate curator in charge of the department of mammals, has been unanimously elected an honorary life member of the Sociedad Colombiana de Ciencias Naturales of Bogotá, Colombia. This honor has been voted Mr. Anthony in recognition of his researches in South America.

The Colombian Society of Natural Sciences was founded some years ago largely through the efforts of Brother Apolinar Maria, who was recently made a corresponding member of the American Museum because of his active interest in South American zoölogy. The society is made up of a group of earnest and enthusiastic students of natural history who have done much to bring to the attention of the world the interesting character of their native fauna.

## THE INTERNATIONAL COMMISSION OF EUGENICS

The International Commission of Eugenics is composed of four officers—Major Leonard Darwin (president), Prof. Henry Fairfield Osborn (vice president), Dr. Albert Govaerts (secretary-treasurer), and Mrs. C. B. S. Hodson (assistant secretary)—and twenty-three other members, representing fifteen countries. The function of this commission is to determine the place and time of the next ensuing congress and to function as an interim committee, authorized to act on other international eugenical matters that require action in the interval between congresses. The first International Congress of Eugenics was held in London twelve years ago. The Second International Congress, which took place in the American Museum in September, 1921, is still fresh in the minds of those who attended it and who listened to addresses of distinguished scientists from all parts of the world.

## NEW MEMBERS

Since the last issue of NATURAL HISTORY the following persons have been elected members of the American Museum, making the total membership 7610:

*Life Members:* MRS. FRANK STEPHENSON VOSS; MESSRS. LEO FEIST, JOHN HEMMING FRY, JOHN P. GRIER, BENJAMIN LOWENSTEIN,

PHILIP G. MCFADDEN, R. A. F. PENROSE, JR., GEORGE F. PORTER, R. S. ROBERTSON, LOUIS A. SCHREINER, JOHN F. SHERIDAN, A. B. SPRECKLES, CHARLES H. SWIFT, AND NORMAN F. TORRANCE.

*Sustaining Members:* DR. EDWARD H. SQUIBB; MESSRS. WM. CARNEGIE EWEN, FRED. P. GEYER, L. NACHMANN, G. A. PFEIFFER, LANSING P. REED, WM. RHINELANDER STEWART, JR., ROBERT G. STONE, AND H. E. WARD.

*Annual Members:* MESDAMES A. DE BONNEVAL, JULES S. EHRICH, JAMES WALL FINN, EDWARD FORD, BERNARD F. GIMBEL, M. GRUNDNER, M. KENNERLEY, EDWARD V. Z. LANE, S. D. LESSER, CARL LEVI, E. SPENCER MEAD, BYRON D. MILLER, CLARENCE MILLHISER, J. B. PATTON, M. RUSSELL PERKINS, CHARLES H. PLATT, NORMAN PUTNAM REAM, CARL A. RICHMOND, GEORGE SCHNELLER, H. C. SCHWAB, CHARLES SEASONGOOD, J. K. OGDEN SHERWOOD, ADAM WEBER, ALEX. H. WILLIAMSON; the MISSES A. P. BENJAMIN, LUCILE G. DENISON, SARAH L. KIRBY, EMILIE O. LONG, MARY G. MILLETT, LUELLA A. PALMER, ERNESTINE PIEZ, EUGENIA R. SEABURY, MARY E. WARNER; SISTER M. EVANGELISTA, SISTER AGNES XAVIER; DOCTORS ERNEST BREHAUT, H. G. CHAPPEL, ALFRED E. COHN, GUSTAV G. FISCH, LOUIS HAUSWIRTH, WM. C. JOHNSON, W. H. KAHRS, LEON M. LESSER, JACOB MUNTER LOBSENZ, WILLIAM P. MACLEOD, WARREN C. MACFARLAND, JOHN P. MCPARLAN, ELI MOSCHCOWITZ, JAMES B. MURPHY, LILLIAN DELGER POWERS, FREDERICK W. RICE, A. I. RINGER, AUGUSTO T. ROSSANO, H. H. SEABROOK, EDWIN S. STEESE, ALFRED WALKER, FREEMAN F. WARD, M. M. WATERHOUSE, CARLETON W. WOODS, JACQUES E. ZIPSER; THE REVEREND JOSEPH P. MCCOMAS, THE REVEREND EDGAR WHITAKER WORK; MESSRS. CARL J. R. AHRNKE, MILTON L. BERNSTEIN, HERBERT R. BOWLES, BERT CLARK, ARTHUR COPPELL, ERNEST W. EAGER, WALTER G. EARL, HENRY W. EATON, NICHOLAS ENGEL, SAMUEL G. EVANS, JOHN J. FALAHEE, FRANK FETZER, G. G. FRELINGHUYSEN, NATHAN GANS, AARON GANTZ, ROBERT O. GAVIN, HENRY GOLDWATER, HARRY GOULD, ADOLPH GRANT, B. M. GRUENSTEIN, EDWARD O. GUDE, ARCHIBALD A. GULICK, RALPH W. GWINN, HENRY HALL HANSON, HENRY C. HASBROUCK, CHARLES EUGENE ISING, N. KANN, MARC KROHN, JEAN LE BLOAS, JOHN LEVY, C. LEWIS, WALTER LOEWENTHAL, WILLIAM JAY MADDEN, GUSTAV MANZ, ARTHUR E. MARSH, ROBERT P. MARSHALL, CHARLES N. MASON, WM. W. MCALPIN, G. W. MEAD, ALBERT MEISTER, DAVID METZGER, ARTHUR S. MEYER, J. E. MILLER, ISIDORE MOSSON, CHARLES F. MURPHY, JR., HENRY KILLAM MURPHY, HARRY T. NEWCOMB, JAMES F. NEWCOMB, LEO H. NEWHOUSE, DAVID E. OPPENHEIMER, LOWELL M. PALMER, JR., SILVIAN PALMER, JOHN S. PARKER, B. HENRY PELZER, W. STANWOOD PHILLIPS, FRANK POEL, AUSTIN E. PRESSINGER, EDGAR S. PRETZFELD, H. H. RAMSAY, ORAN WINTHROP RICE, CHARLES A. W. RINSCHEDE, ABRAHAM ROSENBERG, JOHN M. ROYALL, EDWARD SACHS, FRANCIS B. SANFORD, S. A. SARAFIAN, F. A. SARG, HUGH SATTERLEE, LEOPOLD SCHEPP, ARMIN A. SCHLESINGER, PHILIP SCHLEUSSNER, HERBERT S. SCHOONMAKER, A. R. SEARLES, CLIFFORD SEASONGOOD, JOHN S. SEYMOUR, AL. M. SILVERSTEIN, CHAS. SPIEGEL, CARL B. SPITZER, EDWIN S. S. SUNDERLAND, GEO. N. TIDD, ROBERT R. TITUS, WILLIAM T. VANDERLIPP, WILLIAM H. VON BERGEN, JAMES H. WAINWRIGHT, HENRY L. WALKER, JAMES KNOX WARNOCK, S. J. WEISS, HENRY G. WELTZIEN, PHILIP WESTON, SIDNEY S. WHELAN, A. D. WHITESIDE, HENRY D. WILLIAMS, THOMAS H. WILSON, HERMAN H. WOLFF, M. WOLFF, MARTIN WORTMANN, RICHARDSON WRIGHT, HOWARD E. WURLITZER, H. J. WYATT, W. W. WYCKOFF, JAMES A. WYLIE; AND MASTER TODD HARRIS.

*Associate Members:* MESDAMES FRANCIS W. BIRD, STEPHEN BONSAL, E. NORMAN CURRY, EDWARD G. GARDINER, L. Y. LONG, RIDLEY MCLEAN, EDWARD MORRELL, R. H. PALMER, ANNIE G. PORRITT, PAULINE RISSMULLER, W. H. W. SKERRETT, CLARA FARMER WAITT; THE MISSES MARIA L. CORLISS, MARTHA GAMBLE, RACHEL A. HUSBAND, HORTENSE LEVY, ANN MORGAN, ELIZABETH M. MURRAY, ELIZABETH HAUPT SMITH, RUTH A. STILLMAN, MARY-GORDON VOLKMANN, ERIKA WULFING VON DITTEN, LENA C. WILEY; THE RIGHT REVEREND THOMAS F. GAILOR; THE HONORABLE CLARENCE H. CLARK; JUDGE JOHN BARTON PAYNE; MAJOR LEONARD DARWIN; CAPTAIN FRANK A. POTTS; LIEUTENANT WM. W. WEBSTER; DOCTORS ARTHUR W. BOOTH, MELVIN EUGENE COWEN, ELLIOTT C. CUTLER, HENRY S. DRINKER, ADELBERT FERNALD, PERCY HUGHES, G. CHAPIN JENKINS, J. A. MUNK,

HERMAN R. NIEHAUS, J. WOODS PRICE, W. G. TURNBULL, T. VAN HYNING, ROBERT M. YERKES; THE REVEREND JOHN J. BURKE, C. S. P., THE REVEREND J. A. CALIGAN, THE REVEREND WOLCOTT CUTLER, THE REVEREND EDWIN H. RICHARDS; B. F. RILEY, D.D.; THE REVEREND GEORGE F. WELD; PROFESSORS A. W. BROGGER, EUG. DUBOIS, MARION E. HUBBARD, WILLIAM MANN IRVINE, W. A. NEILSON; MESSRS H. A. ALBYN, EDWARD BAINS, CHARLES M. BARKER, ERNEST HAROLD BAYNES, WM. HUDSON BEHNEY, PRESCOTT BIGELOW, ALBION BINDLEY, LLOYD V. BRIGGS, JR., EDMUND J. BURKE, ALLSTON BURR, L. F. BUTLER, FRANK CAMPSALL, ALEXANDER H. CARY, JOHN L. CASE, EDGAR P. CHANCE, F. C. CHANDLER, CLARENCE A. CHILDS, CHAS. HOPKINS CLARK, G. C. COFFEE, W. R. COLE, R. V. COLEMAN, GEORGE M. CORAM, EBEN F. COREY, BENJAMIN B. COX, RICHARD C. CURTIS, J. B. DE AGUILAR-AMAT, GEORGE M. DOUGLAS, GEORGE W. C. DREXEL, C. W. DUNLOP, GEO. ROSS ESHLEMAN, C. CARSON FEBIGER, 2D, FREDERICK P. FISH, BENJAMIN S. FOSS, WILLIAM C. GEER, HENRY W. GIESE, CARLO M. GIRARD, MORRIS GRAY, WILLIAM A. HERON, ARTHUR HEWITT, JAMES HILLHOUSE, WILLIAM G. IRWIN, A. P. JOHNSON, ERIC KNIGHT JORDAN, ALBERT KAHN, ARTHUR H. LEA, CHONG H. LEONG, JOHN N. LIGHTBOURN, THURSTON V. LITTLE, HENRY S. LOEB, HENRY H. MASON, JAMES EVERETT MCASHAN, JR., MORTON J. A. MCDONALD, J. HORACE MCFARLAND, L. N. MEANS, W. HOWARD METCALF, ROBERT W. MEYER, AUGUST E. MILLER, J. REID MOIR, HUBERT S. MORGAN, JUNIUS S. MORGAN, EDWARD H. PARRY, J. L. PHILLIPS, DARWIN L. PLATT, J. C. PLATT, LESLIE ROGERS, HILLYER V. ROLSTON, RICHARD S. RUDDLE, GEORGE A. RUST, LOUIS H. SCHMIDT, FRANK SCHWARZ, O. B. SPERLING, AARON STRAUS, W. M. STUART, GARDNER T. SWARTS, JR., FRANK M. TAYLOR, EDWARD S. THOMAS, ROWLAND WARD, C. FRED WASHBURN, WALTER J. WATSON, DANIEL S. WEBBER, SINCLAIR WEEKS, M. WEISMAN, WM. B. WHITE, ADRIAN P. WHITING, W. H. WORKMAN, OTTO WÜLFING, AND MASTER PETER WÜLFING.